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Plan for Air Pollution Research in the Texas Gulf Coast Area. Volume V Local Viewpoints on Research Needs

Radian Corp, Austin, TX

Prepared for

Environmental Sciences Research Lab, Research Triangle Park, NC

United States
Environmental Protection
Agency

Environmental Sciences Research
Laboratory
Research Triangle Park NC 27711

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April 1979

Research and Development

PB 295915

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Plan for Air Pollution Research in the Texas Gulf Coast Area

Volume V. Local Viewpoints on Research Needs

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16. ABSTRACT

In response to Congressional mandates, the U. S. Environmental Protection Agency will conduct an extensive study of air pollution related problems in the Texas Gulf Coast Area. As an initial effort, EPA awarded a contract to review the existing technical information and record the local viewpoint on air pollution problems in the area, define research needs, and design experimental studies addressed to these needs. Results are presented in 5 volumes. Volume V presents the solicited local viewpoints on area air pollution problems and related research needs.

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PLAN FOR AIR POLLUTION RESEARCH IN THE TEXAS GULF COAST AREA

Volume V. Local Viewpoints on Research Needs

by

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ABSTRACT

A public meeting was held in Houston to solicit information and viewpoints on air pollution problems in the Houston area and related research needs. This volume presents the testimonies given by local technical experts, representatives of industrial organizations, educational institutions, citizens groups, and private individuals. Testimonies given at Congressional hearings pursuant to Section 403(d) of the 1977 Clean Air Act are also presented as an appendix.

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SECTION 1

INTRODUCTION

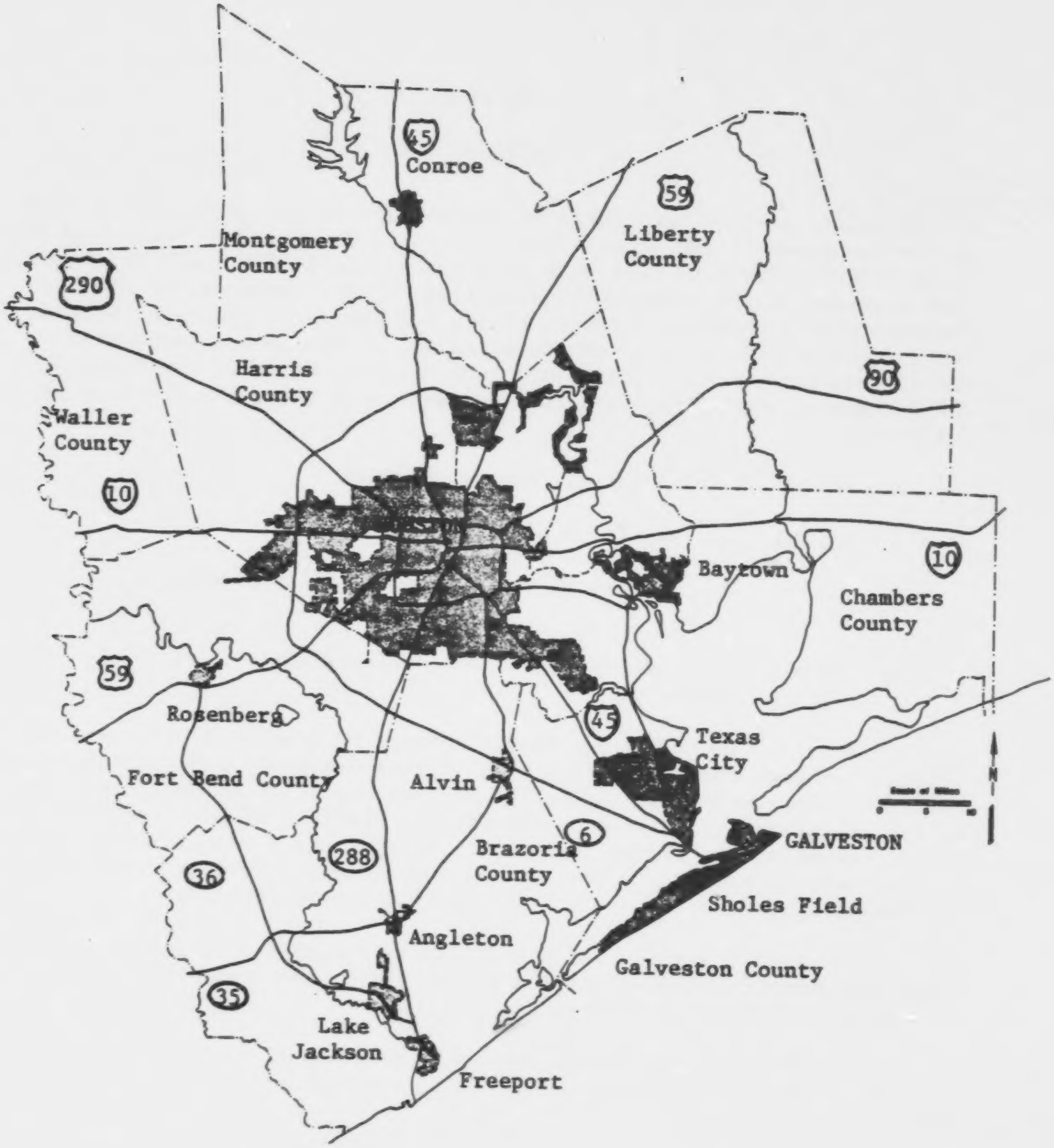
A public meeting was hosted by Radian Corporation on October 3, 1978 to receive comments and suggestions concerning the proposed Texas Gulf Coast Study (TGCS). The TGCS will be a three year, $3,000,000 study of air pollution problems in the Texas Gulf Coast Area (TGCA), sponsored by the U.S. Environmental Protection Agency. Figure 1-1 shows the geographical area of study for the TGCS, with a more detailed map of the immediate Houston vicinity in Figure 1-2. Additional information concerning the Texas Gulf Coast Planning Study, of which this document is a part, are provided in the following:

- Volume I. Plan for Air Quality Studies
- Volume II. Plan for Health Effects Studies
- Volume III. Summary of Previous Air Quality Studies and Data
- Volume IV. Summary of Previous Health Effects Studies and Data

This volume describes the public meeting on October 3, 1978 and provides written comments and suggestions from various organizations and individual citizens. The purpose of the public meeting was to allow public discussion of air pollution and related health effects problems within the TGCA. The ideas, comments, and suggestions received from public and private concerns at this meeting and from subsequent correspondence have been reviewed and considered during the development of the final research plans.

The October 3 meeting was publicized by a letter to specific organizations and a press release. Copies of the letter and press release are presented at the end of this section.

An appendix to this volume contains testimony given at congressional hearings that were held pursuant to Section 403(d) of the 1977 Clean Air Act.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Montgomery County
Liberty County
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Harris County
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Waller County
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Baytown
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Chambers County
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Rosenberg
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Texas City
Fort Bend County
Alvin
6
GALVESTON
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Brazoria County
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Sholes Field
Angleton
Galveston County
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Lake Jackson
Freeport
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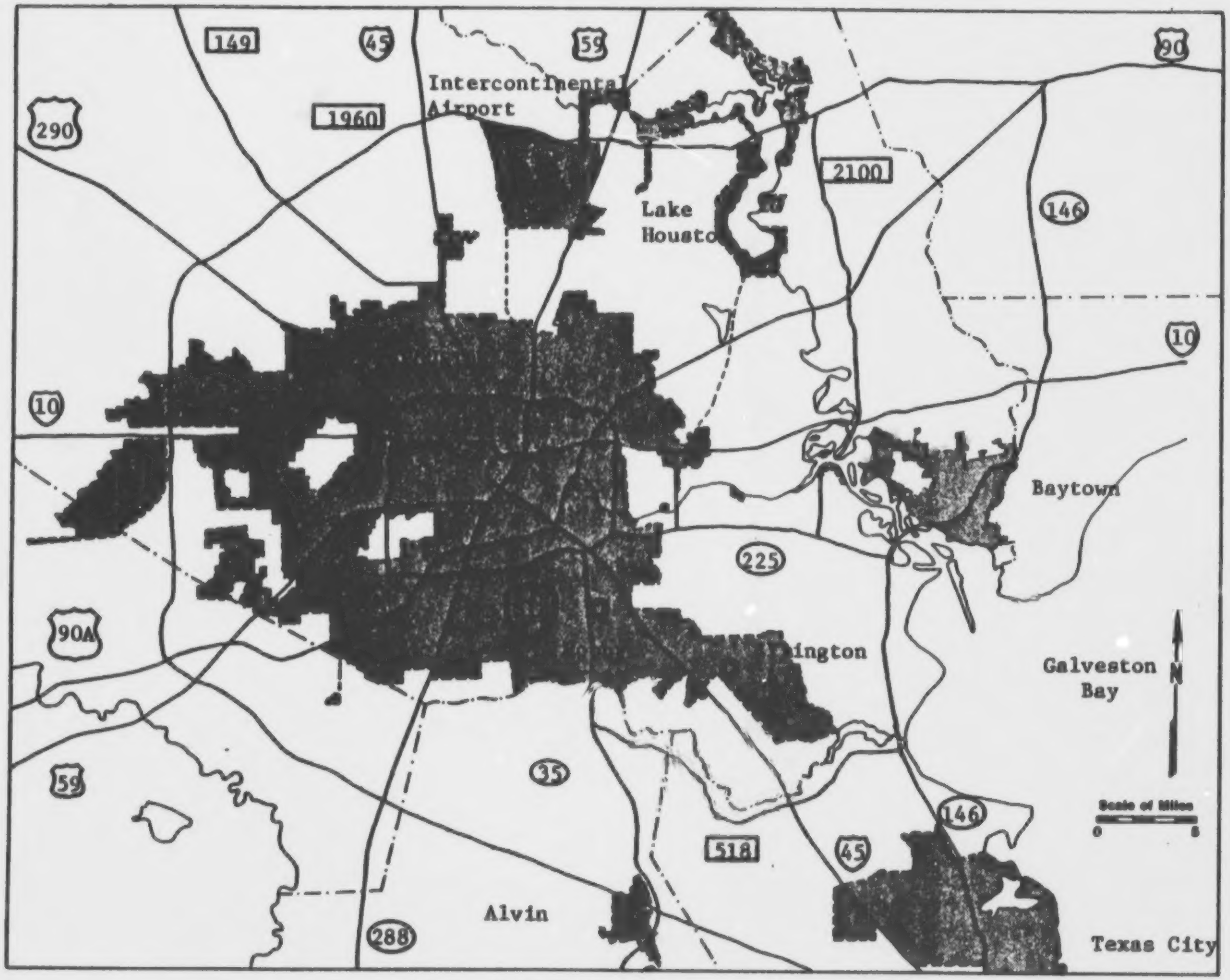
Figure 1-1. Texas Gulf Coast Study Area.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Texas City

Figure 1-2. Immediate Houston vicinity.

LETTER ANNOUNCING THE PUBLIC MEETING

RADIAN
CORPORATION

(SEE ATTACHED DISTRIBUTION LIST)

Under the Clean Air Act of 1977, the U.S. Congress mandated that the Environmental Protection Agency, in cooperation with local groups, identify and develop plans for a research program addressed to the air pollution and related health problems in the Gulf Coast area.

Radian Corporation has been contracted by EPA to develop a plan for a 3-year, 3 million dollar study program in the Texas Gulf Coast area. A copy of the scope of work for this contract is attached. Among other tasks, we are collecting information on air pollution and its health effects in the Texas Gulf Coast region in terms of existing data and expert opinion on air pollution and associated research needs. Identification of local resources for execution of this program is also being sought. This information will be used to prepare experimental designs for the Texas Gulf Coast area to determine the health effects, origin and fate of air pollutants in the area.

An informal meeting has been scheduled in the Briar Grove Room of Holiday Inn Medical Center, 6701 South Main, in Houston for Tuesday, October 3, from 1:30 PM to 8:00 PM and Wednesday, October 4, from 8:30 AM to 12:00 Noon.

The purpose of this meeting, organized by Radian, is to receive written data and other information and viewpoints relevant to the objectives of this project. An opportunity will be provided to the offerers for oral presentations and discussion.

If you do not plan to attend this meeting, please forward your written comments to my attention, Radian Corporation, 8500 Shoal Creek, Austin, Texas 78756, as soon as possible, but before October 3, 1978. If you want to make an oral presentation, please notify us by September 28, 1978.

We are requesting that written comments accompany your oral presentation since no transcript of this meeting will be prepared. Only written comments can be assured the best consideration in the development of this study.

I look forward to seeing and/or hearing from you.

Sincerely,

Gary Tannahill

Gary K. Tannahill
Program Manager

GKT:BJM/eab

EXHIBIT A

Scope of Work

EXCERPT FROM CONTRACT

The contractor shall search for, gather, examine, and perform analyses as needed of existing pertinent information for the purpose of developing and shall develop a plan for a 3-year, $3-million study program in the Texas Gulf Coast area. Bases and justification of resultant study plan shall be derived from such existing information and from expert viewpoint. The contractor shall describe derivation and justification of resultant study plan in a report that will include but not be limited to the presentation/discussion of the following specific subjects.

A. Past Studies in the Texas Gulf Coast Area

Conduct literature survey including formally and informally reported studies, data, and viewpoints on the ambient aerosol oxidant problems, and other air pollutants of concern in the Texas Gulf Coast area.

B. Emissions and Resultant Air Pollution in the Texas Gulf Coast Area

(1) Gather and present summary of emission data with emphasis on organic and NO_x emissions, primary aerosol emissions, and aerosol precursor emissions.

(2) Gather and include summary of ambient pollutant concentration and concentration variation (diurnal, seasonal) data, including but not limited to the aerosol, ozone, oxidant, NO, NO_2, PAN, and non-methane hydrocarbons (collectively and individually), SO_2, NH_3, and sulfates pollutants.

(3) Describe and discuss uniquenesses/peculiarities, if any, of the emissions/pollutant situation in the Texas Gulf Coast area relative to situations elsewhere in the U.S.

C. Meteorology in the Texas Gulf Coast Area

Describe meteorological conditions in the Texas Gulf Coast area and define and discuss any peculiarities/uniquenesses of the meteorological situation in that area relative to situations elsewhere in the U.S.

D. Optimum Design of Health Effects Studies in Texas Gulf Coast Area

(1) Major emphasis should be given to possible health problems associated with air pollutants identified in the Houston area.

(2) Based upon: (a) emissions information; (b) existing aerometric meteorologic data pertaining to chemical and physical characteristics of photochemical pollutants, aerosols, and other air pollutants and their geographic and temporal patterns; (c) demographic considerations; select areas where epidemiologic studies would have the greatest potential for providing unambiguous associations.

(3) Collect and assess available relevant information on health effects associated with pollutant patterns identified in D (2) suggest health indices which could be considered in epidemiologic studies. Available health records and statistics, anecdotal reports, and the scientific literature should be considered.

(4) Suggest specific hypotheses which might be tested and alternative study designs. Special attention should be given to sample size requirements to provide adequate statistical power to test anticipated associations.

(5) Provide recommendations for scheduling epidemiologic studies to derive maximal benefit from research described in E (below).

E. Optimum Design of Study Addressed to Pollutant Nature, Sources, Fate, and Control, for the Texas Gulf Coast Area

First consideration and emphasis should be given to the aerosol and oxidant/ozone and other air pollutants and to the responsibilities of such pollutants primarily to the health-related problems and secondarily to the visibility problem. Study design should include measurement requirements, sampling strategy, quality control, and data processing and archiving procedures. The study should be designed so as to include but not be limited to components addressed to the following broad objectives.

(1) Conduct Physical and Chemical Characterization of Ambient Aerosol

Design field and laboratory testing as needed (a) to obtain and compare chemical and physical character of TGCA aerosols with aerosol data from Los Angeles, St. Louis, and other localities, to identify any unique characteristics related to health and welfare effects, (b) to obtain data on nature, sources, and fate of aerosol pollutants and for devising control strategies, and (c) to develop a baseline data base for comparison with ambient aerosol changes particularly related to increased coal and lignite utilization.

(2) Evaluate Natural Contributions to Aerosol and Ozone Pollution

Design research as needed to assess potentials for aerosol formation from natural organic emissions and for stratospheric ozone intrusion into the Texas Gulf Coast area.

(3) Develop/Improve Air Quality Analysis Capabilities for Ozone Include emission air quality, meteorology trend analysis methods and wind back trajectory techniques.

(4) Validate Ozone and Nitrogen Dioxide Air Quality Simulation Models for Use in Texas Gulf Coast Area. Design field and laboratory testing as needed to test selected air quality simulation models for accuracy of ozone and NO_2 air quality prediction.

(5) Support to Epidemiological Program for Specialized Measurement Needs. Design measurement program consistent with Item D.

F. Local Agency Facilities and Their Possible Role in EPA-Funded Studies in the Texas Gulf Coast Area

Describe existing relevant facilities at the disposal of local (Texas) agencies and institutions (such as State of Texas, City of Houston, Harris County, Universities, NASA, etc.) and identify mechanisms by which such facilities could be involved in EPA-sponsored studies in the Texas Gulf Coast Area.

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PRESS RELEASE ANNOUNCING THE PUBLIC MEETING

RADIAN CORPORATION

AIR QUALITY STUDY PLANNING SESSION SET

Gulf Coast area residents will have an opportunity to participate in a planning session for a $3 million three-year study of the causes and effects of air pollution in the Houston-Galveston area.

The Clean Air Act Amendments of 1977 require the study. Radian Corporation, an Austin-based environmental research and development firm, was selected by the Environmental Protection Agency to design the study plan.

In an effort to gather the most participation from industry, academic and environmental groups and the general public, Radian will hold a two-day planning session October 3 and 4 at the Holiday Inn Medical Center, 6701 South Main in Houston. The meeting times will be 1:30 PM to 8:00 PM on October 3 and from 8:30 AM to Noon on October 4.

Representatives from Radian, and Radian's subcontractor, Southwest Research Institute of San Antonio, will be at the meeting to discuss the objectives of the study and gather comments from interested persons.

The EPA decided to focus the research activities on the Houston area where the air quality problems of photochemical oxidants and aerosols -- the principal ingredients of smog -- are of most concern and where air quality and health effects data are best.

Radian expects to produce a final report recommending topics and study methods by January 15, 1979. Persons or groups interested in making a presentation at the meeting are asked to submit written comments to Gary K. Tannahill at 8500 Shoal Creek Blvd., Austin, Texas, 78766 prior to or at the October 3 session.

SECTION 2

PROGRAM ATTENDANCE

The public meeting on October 3, 1978 was held at the Holiday Inn, Medical Center, in Houston. A panel of representatives from the U.S. Environmental Protection Agency (EPA), Radian Corporation, and Southwest Research Institute (SwRI) conducted the meeting. These representatives included:

- Basil Dimitriades, EPA,
- Robert Chapman, EPA,
- Gary Tannahill, Radian, and
- Don Johnson, SwRI.

John Terry of Radian and John Prevost of SwRI were also in attendance. The scheduled speakers at the planning session included:

Dr. Merle Alexander
Baylor University

James Tarr
Private Citizen

Dr. Stan Pier
University of Texas Public Health

William Beck
Houston Air Oxidants Study

Joe Pyle
Houston-Galveston Area Council

Jim Faucett
Galveston Bay Conservation and Preservation Association

Dr. Hal Cooper
University of Texas at Austin.

All of the individuals who attended the meeting, and signed the registry book kept by Radian are listed in Table 2-1.

TABLE 2-1. PUBLIC MEETING ATTENDEES - OCTOBER 3, 1978

Name	Address	Phone	Representing
Brandt Mannchen	4055 South Braeswood #303	666-6502	Citizen
Judy Martin	2121 Awons 77005	529-2258	Sierra Club
Steve Spaw	8520 Shoal Creek Blvd	451-5711	TACB
Jim Price	8520 Shoal Creek Blvd	451-5711	TACB
Jim Faucette	2807 Crescent View, LaPorte 77571	471-6740	Gal. Bay Cons. Presv. Assoc.
H.M. Walker	Monsanto, Alvin, TX	581-2181	Monsanto
D.E. Evarea	City Houston APC	222-4302	City of Houston
Frank Yu	P.O. Box 22777,Houston,TX 770727	627-3200	H-GAC
Frances V. Smith	302 South Chectcher Houston	465-9755	Citizen
Michael Terraso	P.O. Box 6031 Pasadena, TX 77506	221-5224	Harris County Pollution Control Dept.
Kathy Hogue	Box 1386 Houston, TX 77001	869-4571	SDH & PT
Barbara Levisay	5500 El Cam Del Rey Houston, TX 770081	663-6637	SDH & PT
D.E. Jenkins	1200 Moursuird, Houston, TX 77030	790-4766	Baylor College of Medicine
Jim Tarr	P.O. Box 57310 Webster, TX 77598	488-4264	Toxcon Engineering Co.
Stanley M. Pier	School of Public Health P.O. Box 20186 Houston, TX 77025	792-4421	Univ. of Texas

(continued)

TABLE 2-1. (continued)

Lloyd Stewart	5555 W. Loop Suite 300 Bellaire, TX 77401	713-666-4964	TACB
Wm. B. Beck	P.O. Box 1089 Orange, TX 77630	713-886-6239	HAOS
Brent Miller	1521 Sul Ross Houston, TX 77002	713-221-6116	Harris County
Mary Rollins	5555 Del Monte Houston, TX	713-965-0175	Clean Air Council
Jim Scott	8302 Alborone	771-7606	Self
Nancy J. Shelton	P.O. Box 22777 Houston, TX 77027	627-3200	Houston-Galveston Area Council
Dick Flannery	5555 W. Loop, Suite 300 Bellaire, TX 77401	713-666-4964	TACB
J.L. Moore	510 Riverbend Baytown, TX 77520	626-8100	
Charlotte Frist Faucette	2807 Crescent View LaPorte, TX 77571	471-6740	GBCPA

Abbreviations:
TACB - Texas Air Control Board
GBCPA - Galveston Bay Conservation and Preservation Association
H-GCA - Houston-Galveston Area Council
SDH & PT - State Department of Highways and Public Transportation
HAOS - Houston Area Oxidants Study

SECTION 3

WRITTEN COMMENTS AND REFERENCES

Several of the individuals attending the public meeting submitted written comments and references concerning the TGCS which are included in this section. Also, several individuals who were not able to attend the meeting submitted comments to Radian which have also been included. All of the written comments received by Radian are included here. These comments have been arranged in alphabetical order according to the name of the person who submitted the comments. Most of the comments were submitted by individuals connected with public and private organizations. Several technical papers and reports were also submitted. These additional technical papers and reports have been included as references, which are listed after the comments of the individual who submitted them. Written comments included in this section were received from the following:

Page

Aker, Larry T., Acting Plan Development Manager
Health Systems Agency
Houston-Galveston Area Council.......................... 20

Beck, William B., Chairman,
HAOS Technical Subcommittee
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Bevis, Martha... 37

Clench-Aas, Jocelyne, Sierra Club....................... 40

Cooper, Hal, B.H., Jr., Ph.D., P.E.
Environmental Studies Coordinator
University of Texas at Austin
Center for Energy Studies, Austin....................... 60

Faucette, James R., Chairperson
Air Quality Committee
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Pier, Dr. Stanley M., Chairman
Gulf Coast Air Pollution Research Committee and also Associate Professor of Environmental Health, School of Public Health, University of Texas Health Science Center at Houston.. 86

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Aker, Larry T., Acting Plan Development Manager
Health Systems Agency
Houston-Galveston Area Council

HGAC HEALTH SYSTEMS AGENCY

AN AGENCY OF THE HOUSTON GALVESTON AREA COUNCIL

October 3, 1978

Gary Tannahill
8500 Shoal Creek Blvd
P.O. Box 9948
Austin, Texas 78766

Dear Mr. Tannahill:

This exerpt from the approved draft of the 1978-79 Health Systems Plan is submitted on behalf of the Area's Health Systems Agency.

Sincerely,

Larry T. Aker

Larry T. Aker
Acting Plan Development Manager

LTA:rj

IV.C.1. Air Quality

Air pollution is now recognized as a contributing factor to three major types of disease: cancer, heart disease, and lung disease. There is strong evidence that chronic exposures to air pollutants lead to bronchitis and lung cancer (1). Upper respiratory distress, eye irritation, sore throat, headaches, nausea, and increased airway resistance may also be caused by exposures to certain pollutants in community (ambient) air (2).

Cancer

Of particular concern to Houston-Galveston Area is the high cancer mortality rate for cancer of the respiratory tract. Some counties of the area have rates that are described as among the highest in the country. Tables 27 & 28, p.58 give the mortality rate for various anatomical sites for all 13 counties in the H-GAC/HSA region. Studies by the National Cancer Institute conducted in counties with high cancer mortality rates indicated that counties with concentrations of petroleum industry workers experienced significantly higher rates for cancer of the lung, nasal cavity and sinuses, and skin as compared to male residents of non-petroleum industry counties having similar demographic characteristics (33). More study will be required to determine whether these patterns result from exposure to airborne chemical carcinogens or some other cause.

New data on regional cancer mortality rates from an unreleased study by the University of Cancer Center and Texas Health Department appears in Appendix IV.c.1.

Respiratory Disease

Mortality rates from respiratory diseases have been reduced considerably but still account for over half (52%) of all acute health problems. The role of air pollution in the etiology of respiratory diseases is not fully understood, but linkages between pollution and both chronic and acute respiratory diseases have been found. The following discussion of morbidity information may help develop a perspective on respiratory disease in the United States (24).

Over half (51%) of all bed days for acute health problems are respiratory. Over half (58%) of school days lost are for acute respiratory problems. Forty-three percent of work-loss days are for acute respiratory problems. There are an estimated 15.4 million persons in the United States that suffer from a chronic obstructive lung disease. If air pollution affected only those with chronic lung disease, it would still have an impact on one out of every 13 persons in the U.S. (4)

Other Effects of Pollution

Polluted air is a costly nuisance. In additon to health care costs, pollution damages vegetation, crops, and livestock, and increases maintenance costs through damage to paint, metals, and textiles. It reduces sunlight and visibility and annoys the public by its unpleasant smell. In 1976, the U.S. Environmental Protection Agency estimated air pollution costs to be over $21 billion per year. This total amounts to more than $90 per person per year. The cost of air pollution in health care is estimated to be $6.1 billion, including costs of medical bills, lost time, and premature death.

Air Pollution Control

Air contamination is caused by both natural and man-made sources. Pollution results from almost all human activities, transportation, industrial processes, agriculture, refuse disposal, domestic activities and recreation. Normally, the only consequential sources of pollution in the H-GAC/HSA region are from transportation and industry. In response to similar air pollution problems throughout the country, Congress established standards within the 1970 Clean Air Act which define air quality with respect to specific pollutants. Table 2 describes the primary and secondary standards for each of the six criteria pollutants. The 1977 Clean Air Act Amendments require the designation of areas that have not attained one or more of these standards. Several counties in the region, Harris, Galveston, and Brazoria, have been designated as "non-attainment areas" for photochemical oxidants. Ozone levels have been seen to rise and fall over much of the area indicating this is a regional pollution problem as well as a "point source" emissions problem. For another pollutant, called particulates, several small areas of Harris and Galveston counties are also designated as non-attainment areas. (These are areas which have not met the standards as set forth in the Clean Air Act.)

TABLE 2

Ambient Air Quality Standards

Source Texas Air Control Board

National Standards	Primary*	Secondary**
Carbon Monoxide (CO)	35 ppm hourly average, not to be exceeded more than once a year	same as primary
	9 ppm eight hour average, not to be exceeded more than once a year	
Nitrogen Dioxide (NO_2)	0.05 ppm annual average	same as primary
Non-methane Hydrocarbons⁺	0.24 ppm 6-9 a.m. average, not to be exceeded more than once a year	same as primary
Photochemical Oxidants	0.08 ppm hourly average measured as ozone, not to be exceeded more than once a year	same as primary
Total Suspended Particulate Matter	260 $\mu g/m^3$ 24-hour average, not to be exceeded more than once a year	150 $\mu g/m^3$ 24-hour avg., not to be exceeded more than once a year
	75 $\mu g/m^3$ annual geometric mean	60 $\mu g/m^3$ annual geometric mean⁺
Sulfur Dioxide (SO_2)	365 $\mu g/m^3$ (0.14 ppm) 24-hour average, not to be exceeded more than once a year	1,300 $\mu g/m^3$ (0.5 ppm) three hour average, not to be exceeded more than once a year
	80 $\mu g/m^3$ (0.03 ppm) annual average	

* Primary standards define levels of air quality which the U.S. Environmental Protection Agency's (EPA) Administrator judges necessary to protect the public health with an adequate margin of safety.

** Secondary standards define levels of air quality which the EPA Administrator judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

⁺ These are for use as guides in achieving other standards. The non-methane hydrocarbon level relates to the oxidant standard; the 60 $\mu g/m^3$ geometric mean relates to the 24-hour standard for particulates.

IV.C.1. Air Quality

Air pollution is now recognized as a contributing factor to three major types of disease: cancer, heart disease, and lung disease. There is strong evidence that chronic exposures to air pollutants lead to bronchitis and lung cancer (1). Upper respiratory distress, eye irritation, sore throat, headaches, nausea, and increased airway resistance may also be caused by exposures to certain pollutants in community (ambient) air (2).

Cancer

Of particular concern to Houston-Galveston Area is the high cancer mortality rate for cancer of the respiratory tract. Some counties of the area have rates that are described as among the highest in the country. Tables 27 & 28, p.58 give the mortality rate for various anatomical sites for all 13 counties in the H-GAC/HSA region. Studies by the National Cancer Institute conducted in counties with high cancer mortality rates indicated that counties with concentrations of petroleum industry workers experienced significantly higher rates for cancer of the lung, nasal cavity and sinuses, and skin as compared to male residents of non-petroleum industry counties having similar demographic characteristics (3). More study will be required to determine whether these patterns result from exposure to airborne chemical carcinogens or some other cause.

New data on regional cancer mortality rates from an unreleased study by the University of Cancer Center and Texas Health Department appears in Appendix IV.c.1.

Respiratory Disease

Mortality rates from respiratory diseases have been reduced considerably but still account for over half (52%) of all acute health problems. The role of air pollution in the etiology of respiratory diseases is not fully understood, but linkages between pollution and both chronic and acute respiratory diseases have been found. The following discussion of morbidity information may help develop a perspective on respiratory disease in the United States (24).

Over half (51%) of all bed days for acute health problems are respiratory. Over half (58%) of school days lost are for acute respiratory problems. Forty-three percent of work-loss days are for acute respiratory problems. There are an estimated 15.4 million persons in the United States that suffer from a chronic obstructive lung disease. If air pollution affected only those with chronic lung disease, it would still have an impact on one out of every 13 persons in the U.S. (4).

Other Effects of Pollution

Polluted air is a costly nuisance. In additon to health care costs, pollution damages vegetation, crops, and livestock, and increases maintenance costs through damage to paint, metals, and textiles. It reduces sunlight and visibility and annoys the public by its unpleasant smell. In 1976, the U.S. Environmental Protection Agency estimated air pollution costs to be over $21 billion per year. This total amounts to more than $90 per person per year. The cost of air pollution in health care is estimated to be $6.1 billion, including costs of medical bills, lost time, and premature death.

The success of implementing air pollution control procedures locally has been marked, with sharp reductions in particulate and hydrocarbon emissions occurring since 1971. Decreases in particulate emissions have considerably reduced unpleasant visible emissions. Industry in the H-GAC/HSA area has done a great deal to reduce emissions from fixed point (industry) sources, yet these sources still contribute about 64% of the hydrocarbon emissions. Mobile sources (motor vehicles) emit about 35% of the total hydrocarbons.

The regulatory agencies that are involved with air pollution controls are the local health departments in Houston and in Galveston County, the Texas Air Control Board, and the Environmental Protection Agency. Regular air pollution monitoring activity is conducted in Walker, Matagorda, Chambers, Harris, Galveston and Brazoria counties at 67 monitoring sites. The majority of the regulatory and monitoring activity is conducted by the local air quality programs in Galveston and Houston. The remainder is done by the Texas Air Control Board, which also reviews permit applications by industries requesting to operate new facilities that have the potential for pollution emissions into the environment (5).

The Air Quality Plan

Even though the air quality management program in the state is among the largest in the country, Congressional hearings in November 1977 confirmed that much remains to be done in the Gulf Coast Area to assess the health impact of air pollution. Most of the health effect studies upon which the current standards are based failed to consider the health effects of specific air pollution problems acting in concert with other regional environmental factors such as high humidity and summer temperatures or other air contaminants. Objective 2 in the Air Quality Plan reflects a desire by the H-GAC/HSA to promote a greater understanding of the role of air pollution in community disease patterns. Because of the dynamic nature of policy development by the regulatory agencies, changing fuel use patterns and the ever increasing number of cars on our streets and freeways, the Health Systems Plan also reflects the need for promoting a health perspective by community decision makers and air control agencies concerning future emission policies.

ENVIRONMENTAL HEALTH (AIR)

HEALTH STATUS GOAL V
REDUCE MORBIDITY/MORTALITY DUE TO ENVIRONMENAL AND OCCUPATIONAL RELATED CAUSES.

STATUS OBJECTIVE 2: REDUCE MORBIDITY/MORTALITY RELATED TO AIR POLLUTION

INDICATORS: 1) Cancer incidence/mortality rate 2) Incidence of obstructive lung disease

SYSTEMS GOAL 1.
ATTAIN A LEVEL OF AIR QUALITY THROUGHOUT THE REGION ADEQUATE TO PROTECT THE PUBLIC HEALTH AND WELFARE CONSISTENT WITH CONSERVING ENERGY AND MAINTAINING REASONABLE ECONOMIC ACTIVITY

OBJECTIVES	RECOMMENDED ACTIONS	IMPLEMENTATION STRATEGIES	RESOURCE REQUIREMENTS
1. Attain primary air quality standards throughout the region with plans to maintain such a level in effect. INDICATOR: the monitored level of pollutants as compared to the National Ambient Air Quality standards.	1. Regulatory and planning decisions by agencies involved with developing portions of the State Implementation Plan for Clean Air that apply to the HGAC/HSA area will reflect a sound health oriented perspective.	1. Health related organizations will advocate a strong health oriented perspective in public hearings and other forums designed to acquire public and technical input on air quality issues.	
	2. Air pollution control agencies will continue to improve air pollution monitoring activities necessary to detect changes in the level of pollution emissions and ambient pollution levels.	1. At a minimum, in 1979 local air pollution control agencies will maintain the existing level of pollution monitoring activity.	(for Actions 2 & 3) MANPOWER: Air Pollution Division, Galveston and Houston Health Departments, area media representatives, EPA technical staff Air Quality task force
	3. The public will be provided timely media information on local air pollution levels in high pollution areas.	1. Local air pollution control agencies will attempt to establish or refine Pollution Standards Index (PSI)	FACILITIES: Existing COST: $600 for media/health departmen

ENVIRONMENTAL HEALTH (AIR)

SYSTEMS GOAL 1.
ATTAIN A LEVEL OF AIR QUALITY THROUGHOUT THE REGION ADEQUATE TO PROTECT THE PUBLIC HEALTH AND WELFARE CONSISTENT WITH CONSERVING ENERGY AND MAINTAINING REASONABLE ECONOMIC ACTIVITY.

OBJECTIVES	RECOMMENDED ACTIONS	IMPLEMENTATION STRATEGIES	RESOURCE REQUIREMENTS
1. (Continued)		reporting procedures in 1979.	workshop plus normal Health Department funding.
SUBOBJECTIVE: To stabilize the increase in automobile emissions in local oxidant non-attainment areas by 1983.	4. A transportation system capable of reducing air pollution and vehicle miles travelled per capita will be established.		
2. The body of knowledge on the health impact of local air pollution problems will be refined to assure the applicability of air quality control measures.	1. Establish a respiratory disease surveillance program designed to investigate the health effects of air pollution in high pollution areas.	1. The Houston Health Department will attempt to establish and coordinate a study to investigate the short term health effects of air pollution episodes.	(For Actions 1 & 2) MANPOWER: Three additional personnel in the Houston Health Department, support from the University of Texas School of Public Health and the University of Texas Medical Branch (epidemiologists, systems analysts, programmer, graduate students) FACILITIES: Existing COST: $130,000 for two years (1979-80); $45,000 for two years (1981-82)
INDICATOR: To be developed.	2. Support the current efforts to establish a control strategy to identify and limit air borne carcinogens.		

ENVIRONMENTAL HEALTH (AIR)

SYSTEMS GOAL 1.
ATTAIN A LEVEL OF AIR QUALITY THROUGHOUT THE REGION ADEQUATE TO PROTECT THE PUBLIC HEALTH AND WELFARE CONSISTENT WITH CONSERVING ENERGY AND MAINTAINING REASONABLE ECONOMIC ACTIVITY.

OBJECTIVES	RECOMMENDED ACTIONS	IMPLEMENTATION STRATEGIES	RESOURCE REQUIREMENTS
3. Encourage the efficient use of energy resources to discourage conversion to coal in or near non-attainment areas. INDICATOR: changes in the monitored levels of SO_2 in non-attainment areas.	1. The establishment of an annual sulfur dioxide report.	1. Publication of a report to the public on changes in local air quality as a result of changes in fuel use patterns by an appropriate regional agency. Where possible, the report will assess changes with respect to the health effects of those at greatest risk.	

Beck, William B.
Chairman
HAOS Technical Subcommittee
Houston Area Oxidants Study

HOUSTON AREA OXIDANTS STUDY
P. O. Box 53269
Houston, Texas 77052
(713) 651-1313

January 5, 1979

Mr. G. K. Tannahill
Senior Program Manager
Radian Corporation
P. O. Box 9948
Austin, Texas 78766

Dear Mr. Tannahill:

The following comments are submitted by the Technical Subcommittee of the Houston Area Oxidant Study to the Radian Corporation. HAOS, a project sponsored by the Houston Chamber of Commerce to investigate aspects of air pollution in the Houston Area, has been a cooperative effort from its outset in 1976. Contacts have been maintained with the various regulatory agencies, specifically the Texas Air Control Board, the City of Houston and the U. S. Environmental Protection Agency; and others engaged in air pollution activities. The EPA-Research Triangle Park, has been informed of the HAOS activities and research plans. These comments represent, therefore, a general review of what information has already been supplied to the EPA as pertaining to the current EPA study of Houston air pollution. Additionally, comments are included that were presented to the EPA as the results of the HAOS project became known.

It is the sincere desire of the Houston Chamber of Commerce and other sponsors and participants in the HAOS project that the results of HAOS may serve the new EPA research effort in the Houston Gulf Coast an as extension of the data base, and to provide a foundation upon which EPA effort can build new understanding. To this end all HAOS data and project analysis will be made available to the EPA and the general public.

Sincerely,

Wm B. Beck

William B. Beck, Chairman
HAOS Technical Subcommittee

WBB:aeb
Att.

COMMENTS ON
EPA AIR POLLUTION RESEARCH PLANNING

Presented By
The Houston Area Oxidant Study Technical Committee
to
The Radian Corporation
October 12, 1978

***

From the perspective of planning, executing and now wrapping up an extensive multi-disciplined air pollution research program in the Houston Area, the HAOS technical subcommittee appreciates the logic of the current efforts of the EPA to solicit input into the formation of both an air chemistry research plan and a plan for health effects studies.

A. BASICS TO ANY RESEARCH REPORT

The following major points are recommended as basic to any research effort:

1. Planning

Formation of a plan that is both comprehensive, to evaluate the coordinated effects of the many facets of air pollution and yet at the same time detailed enough to allow for close examination and control of the critical specific parts. Such planning should include such inputs as:

- Hypothesis testing,
- Reevaluation of previous research efforts, both in the local area and elsewhere,
- Adequate consolidation with local research groups.

2. Peer Reviews

Peer reviews of plans and specific projects that comprise the plan were an important aspect of the HAOS program. Most major projects received a peer review prior to starting the project. This is essential to insure all the critical aspects have been considered.

Major investigations into health and socio-economic effects required both a prestudy and post-study reviews. In addition to peer reviews, the EPA should also involve the general public to the greatest extent possible to afford the public opportunity for input.

3. Data Quality Assurance

Data quality assurance has proven to be an essential but expensive part of the HAOS aerometric monitoring program. While selection of competent contractors who are experienced in air quality monitoring and who have extensive QA laboratory capabilities is necessary to a good data quality program, a separate and independent audit program will prove valuable.

Based on HAOS experience, the value of an independent third party QA check is certainly equal to what would be gained by increasing the frequency of internal audits. Moreover, an outside QA check brings to the QA program the added creditability of the third party.

4. Open Review of Data

To the foundation of good planning, peer review and an extensive QA program, timely reporting and review of data strengthens any research program. While this is sometimes limited by the complexity of the data and its analysis, much value is gained by a review of the results as early as possible. This is especially true in research efforts such as these where public participation and interest is so great.

5. Establishment of an Accessible Data Archive

A recent trend in regional air pollution studies is that they provide for the establishment, or add to an already existing data base. This archive of data must understandably be accessible and in a format that is usable by others with wide variations in facilities and interests. For this reason, HAOS established both an extensive computer based data archive and also established, where possible, hard copy data summaries and individual project reports. The advantage of these individual project reports is that they allowed for an early release to the public of the specific work, allowed for results to be presented in hard copy, and yet provided for overall analysis.

B. AIR MONITORING - GENERAL COMMENTS

The foundation of air pollution research is an adequate knowledge of air quality and the weather patterns or meteorology that exerts so much influence on air pollution. While this can differ from location to location, depending on many factors, for the Houston area, HAOS has found that a rather extensive air monitoring network is essential to accurately characterize the area's air quality and to provide the basis for any attempt to identify the sources, the fate and impacts of this air pollution. To this end HAOS established a multi-station ground network shown in the attached Figures 1 and 2, which extended from Hempstead, northwest of Houston, to an off-shore oil rig platform some 60 km southeast. This network included existing regulatory stations, TACB, City of Houston and the EPA, as well as volunteer industrial and private research sites to augment the sites and equipment operated by HAOS contractors. Over 30 ground sites were used for HAOS monitoring. In addition to the ground stations, HAOS also used a fixed wing aircraft to monitor the area in three dimensions. This aircraft monitoring has greatly expanded the fixed station network in terms of the vertical distribution of pollutants. Moreover, it has also give HAOS a perspective to upwind, crosswind and downwind air quality. For a comprehensive evaluation and assessment of air quality, the monitoring network must be more extensive than what is currently in the plan and must be capable of evaluating the quality of the background or transported air that washes the Texas Coastal Zone with the diverse and frequent changes in the area's meteorological conditions.

1. Ground Station Monitoring Limitations

During the HAOS monitoring program, concern was expressed about the ability of point monitoring located at a height of three to five meters to adequately represent the true quality of air around this point. This same issue has received considerable attention by others. Increasing the number of points sampled and frequency of sampling improves the representativeness of the data. However, the issue of air quality with depth or height of the atmosphere is not addressed. The HAOS effort at three dimensional monitoring, while limited, reveals that ground station sampling by itself can be misleading. For a variety of meteorological reasons the concentration of pollutants in the air can be altered over a wide range. Inversions, changes in mixing depths, wind shear and pressure gradients can all affect this. Since many pollutants are carried aloft and transported that are difficult to detect with ground level monitors, care must be exercised in attempting to extrapolate ground station point sampled data.

2. Use of Distant Ground Station Monitors

The HAOS experience in assessing the general air quality in the Texas Gulf Coast has led to the observation that there are frequent widespread episodes of air quality changes. This is especially true for ozone. The significance of this to the question of monitoring is that, while monitors in the Houston area may indicate different levels of pollutants, they should be integrated with values from surrounding cities, even out to 100-200 miles distant, to provide a better picture of possible causes of air pollution on a "macro" scale.

3. Air Monitoring Duration

The HAOS experience in monitoring air quality and in studying the TACB records for the past years indicates that the period of air pollution activity must be regarded as variable at best. Thus variability appears to be related to the variability in weather conditions from year to year and month to month. A monitoring program must take this into account. For example, in a given year, moderate to strong ozone levels have been recorded as early as March and as late as November. However, isolated examples of ozone peaks have been measured in every month of the year. The levels of other pollutants have not been followed as closely as ozone but it is expected that they would be similar in behavior.

C. AIR MONITORING - SPECIFIC POLLUTANTS

Incorporated into the HAOS program were projects aimed at the monitoring of specific non-criteria pollutants. This was done either because no such data on these pollutants existed, these pollutants were indicators of other more generalized air pollution problems or they could be used as tracers or surrogates to help in understanding the sources or causes of air pollution. The following comments include specific pollutants HAOS did monitor and some that in retrospect should have been monitored.

1. Beryllium-Isotope

This relative short half life isotope of beryllium is beginning to be studied as an indicator of significant stratospheric air intrusion into the lower troposphere. HAOS included it to a limited extent in our intensive air monitoring program conducted in the Houston area in the summer of 1977. Preliminary data, as measured by the radio activity of particulate matter indicates that there are substantial intrusions of Be^7 into the ground level atmosphere at various times during the fall months. These intrusions may be associated with macroscale weather changes and also seem to be related to increases in measured ozone levels. This is the first such data collected in latitudes as low as the Houston area. This work should be repeated for several summer-fall periods.

2. Peroxyacetyl Nitrate (PAN)

HAOS through its contractor, Rockwell International, collected extensive PAN data. Levels in Houston were found to be low relative to the California basin. This work should be repeated over at least one more season. The relationship between ozone and PAN should also be studied more completely.

3. Detailed Hydrocarbons

HAOS has devoted a limited amount of its effort to detailed hydrocarbon analysis. The benefit of this knowledge is obvious. Particular attention should be paid to identified hazardous pollutants such as benzene, polynuclear aromatics and others of this nature. These higher molecular weight hydrocarbons may exist as aerosols, or as absorbed on the surface of particulates. Special sampling and analytical techniques will need to be used. HAOS recognized the limitations of its GC-FID and GC-MS programs in this regard.

Natural hydrocarbons, the terpenes, etc. are quite reactive and must be analyzed very quickly after samples are taken. Sample containers and techniques are critical--specially cleaned stainless steel containers were used in the HAOS program. Another aspect of hydrocarbon studies that HAOS was unable to examine was the nature of hydrocarbons collected over water as compared to urban and rural samples. Additionally, it is important to establish the vertical extent, nature and concentration of hydrocarbons in the atmosphere.

In the Houston area it has been suggested that anthropogenic sources account for considerably less of the total hydrocarbons than expected. Biogenic sources of hydrocarbons, normally referred to as natural sources, are a big factor. Finally, the role of geogenic source hydrocarbons has been largely neglected. This could be a most significant factor.

4. Other Compounds

Some other compounds of potential interest in an air monitoring program are: nitric acid and hydroxyl radicals, asbestos, lead and other heavy metals in the respirable range.

D. HEALTH EFFECTS STUDIES

The challenge of a meaningful air pollution health effects study is a complex and tough one to meet. The literature is full of critiques on the pros and cons of previous studies. HAOS contracted with Equitable Environmental Health to review and critique previous work before selecting the Houston Longitudinal Asmatics Study performed by Baylor College of Medicine and Southwest Research Institute. A copy of the Equitable Planning study is attached and it contains a presentation of some five other studies that could be performed in the Houston area. HAOS believes that some combination of epidemiological/chamber or controlled environment test would represent a good compromise. Selection of subjects and test protocol could be designed to incorporate the stress factor which is normal in most chamber studies. Unfortunately, chronic exposure versus acute exposure is a key question that is not answered even in a 6 month or longer test. One observation made by HAOS as a result of it Houston Health Response Study is that design of the study protocol and design of the data analysis is critical to obtain clear cut results. Another observation is that a study is likely to produce more data than anticipated and so a sizable allocation of funding should set aside for data analysis. In this regard, a first approach EPA might wish to take is to examine more fully the HAOS Health Study results. These should be available early in 1979.

Another suggestion regarding an EPA study would be to extend the HAOS study into the second and third air pollution season, using all or some of the same participants. This would eliminate considerable expense and time in getting such a study underway. Additionally, EPA could alter the program with a minimum of effort to add or delete objectives.

E. OTHER SUGGESTED AIR POLLUTION STUDIES

As a result of the experience gained in the HAOS project, the following additional studies are suggested for EPA's consideration. HAOS will be happy to expand on these if requested.

1. Captive Air Bag Studies

"Smog" chamber studies, largely conducted indoors, have not really explained real world behavior in air pollution studies. HAOS suggests that a large (1,000 cu. ft.) captive air bag chamber be operated in the Houston area to conduct tests on real world air and solar radiation conditions. This chamber could be moved about the area to sample different air mixes. HAOS has such a chamber and would make it available to the EPA for this research. Additionally, HAOS has obtained several interesting and sound captive air bag research plans from outside contractors. These plans have already been provided to the EPA.

2. Ozone Episode Studies

The behavior of ozone has been characterized as area-wide ozone fluctuations affected by localized increases and decreases from local causes. The question of this area-wide base level of ozone has been difficult to study. It could however explain the phenomenon of ozone episodes that have been observed over areas hundreds of miles in size. Because of the general flat and basin-like character of central and southeast Texas, this is an ideal area for study.

Bevis, Martha

October 4, 1978

Radian Corporation
8500 Shoal Creek Blvd.
Austin, Texas 78766

Re: Possible Fluoride Emissions
Houston-Galveston Area

Att: Mr. Gary K. Tannahill

Gentlemen:

The enclosed material will give you the basis for including possible fluoride emissions in your study of causes and effects of pollution in the Houston-Galveston area.

This summer I talked to Dr. Flannery at the Texas Air Control Board and he said they check for fluoride if it is suspected; that the last check they had made was a plant in La Porte in '72 or '73. He suggested I send information to Mr. Bill Stewart. I didn't get around to doing that, and since you were conducting a study here, I thought it best to give it to you. Perhaps you will share this information with Mr. Stewart.

1. ENVIRONMENTAL FLUORIDE 1977: National Research Council of Canada. This is the latest and most comprehensive study published - July, 1978. Additional copies did not arrive in time so I copied a part of this 156 page study. See index for all material covered.

2. INTERN. JOURNAL ENVIRONMENTAL STUDIES: "The Summing of Fluoride Exposures".

3. MICHIGAN STUDY OF TOTAL FLUORIDE INTAKE: Statement of Gov. Milliken. The Michigan study for total fluoride intake is being done because the fluoride ion affects human health whether it enters the body via food, air or water. Gov. Milliken had asked that this study be finished by July. You might check and see what the status is at this time.

4. MONITORING FLUORIDE POLLUTION: Insect & Disease Branch, Forest Service, Missoula, Montana. I've copied part of this study to show you the type of testing they used.

5. EPA ABSTRACT NO. 28556 - 1971: EPA will furnish you with hundreds of additional abstracts on fluoride.

6. AIR POLLUTION PRIMER: American Lung Assoc. The chapter on fluorides is enclosed.

7. JOURNAL OF THE AMERICAN MEDICAL ASSOC.: "Chronic Fluorine Intoxication". States that in 1943 25,000 tons of fluorine went into the atmosphere annually.

8. NEWSPAPER ARTICLE: April, 1978, Fluoride emission, Urbana, Ohio.
9. LIBRARY OF CONGRESS: "Effects of Chronic Exposure to Low-Level Pollutants in the Environment". This was published in 1975 and you should be able to get it from the Library of Congress.

10. **NEWSPAPER ARTICLE:** Soybean Contamination - Tulane Univ.

PARTIAL LIST OF INDUSTRIES WITH POSSIBLE FLUORIDE EMISSIONS:

> Steel, fertilizer (phosphate), aluminum, iron, ceramics, brick, copper, glass, cement, chemical, hydrofluorice acid production, zinc, tile, petroleum, clay, coal (used as energy), teflon, nuclear (rocket propellant), frit smelting, plastics, areosols, lead. (One study stated more than fifty industries have possible fluoride emissions).

Since fluoride in any form affects human health, I include the following:

11. **LIST OF STUDIES OF HEALTH EFFECTS OF FLUORIDE:** Submitted to Committee on Fluoridation (from Rice, TSU and U of H) set up by Houston City Council.

    If, after looking at the above list, there are special studies you want, please call me.

12. **ADVERSE EFFECTS OF FLUORIDATION:** Submitted to Houston City Council by Committee on Fluoridation.

Sincerely,

Martha Bevis

Mrs. R. M. Bevis 686-8391
7706 Brykerwoods
Houston, Texas 77055

CC: Dr. Flannery, T.A.C.B.
Dr. McKee, Air Pollution Control
Mr. Akers, Health Systems Agency
Dr. Raymer, San Jacinto Lung Assoc.
Others

Clench-Aas, Jocelyne
Sierra Club

December 5, 1978

Jocelyne Clench-Aas
1023 Lyndon # 8
Houston, Texas 77030
Home Phone: (713) 790-1956
Office (713) 792-4321

Gary Tannahill
Program Manager
Radian Corporation
8500 Shoal Creek Blvd.
P.O. Box 9948
Austin, Texas 78766

Dear Mr. Tannahill,

I am sending you a copy of a critique I did on behalf of the Sierra Club concerning the Health Effects Section of the Houston Study, Contracts and Grants. This document has been sent to Dr. Chapman of the EPA. I would very much appreciate any comments you may have and can be reached at the above address and phone numbers.

This is not intended to be a literature review nor a proposal, merely a set of suggestions.

In order to let you know a little of my background I am enclosing a curriculum vitae and abstracts of some of our papers. I am also enquiring about the possibilities of employment within your organization at Radian, in the air pollution study since I am most interested in it.

I look forward to hearing from you and remain,

Sincerely yours,

Jocelyne Clench-Aas

Jocelyne Clench-Aas

The briefness of the Health Studies section of the Contracts and Grants of the Houston Study, leaves the reader unclear as to how questions will be resolved. As I see it, there are two primary problems to be solved: 1) what is the lowest level of photochemical oxidants in the atmosphere tolerable to human health, and 2) what health effects can be anticipated due to chronic exposures to low doses and acute exposures to more critical doses. The solution to these problems necessitates answering two secondary questions: 1) which group of individuals constitute the "at risk" population and 2) have urban dwellers "adapted" to pollution (Bell et al. 1977, Hackney et al. 1977).

"At risk" individuals are those least able to physiologically adapt either through impaired detoxification systems or inability to physiologically compensate. The capacity to adapt is a function of environmental, physiological and genetic factors operating together. Therefore these three areas need to be taken into account in planning a protocol. Differences in any of the above areas can lead to altered physiological states, thus altering the capacity to adapt.

To facilitate this discussion I am only concerned here with photochemical oxidants (hereafter referred to as ozone). However, most of this discussion pertains to the other pollutants as well.

ENVIRONMENTAL FACTORS

1) Climate

Houston has a particular combination of climatic features that distinguishes it from Los Angeles, thus necessitating a special experimental protocol. Although we share the same lack of temperature extremes, the range in Houston is greater than the range in Los Angeles. What is especially notable in Houston is the high humidity (often around 100%) coupled with high temperatures, two factors that have been indicated as potentially affecting lung functional response (Folinsbee et al. 1977 as cited in EPA document 60018-78-004, Stokinger 1965).

2) Air Quality

Air quality is a function of both manmade and natural pollution. It seems to have a seasonal component (Houston Study Section C-9) as well as a daily component.

In evaluating health effects on man, however, several additional parameters need to be kept in mind since they ultimately affect the air quality surrounding particular individuals.

Socio-economic status can have sizeable ramifications on the quality of the air breathed. The use and effectiveness of air conditioning as well as heating is a function of socio-economic status. Likewise certain classes of society are more likely to be situated geographically near refineries, storage tanks etc. In addition those working in industrial plants face another quality of air. The toxicity of interacting pollutants (including industrial pollution) remains largely unknown.

Superimposed on these environmental trends are seasonal and daily patterns of climate, pollution and activity. For example, joggers tend to jog before or after work, i.e. 06^{66} or 18^{00} (military time). Evening joggers are subject to highest environmental pollutant load. Similarly, although winter is not necessarily the highest pollution season, it involves the least use of air conditioning and probably the least air filtration. Houston has an exceptionally high pollen load whose effects may aggravate existing pollution effects and whose seasonal rhythm seems to coincide with pollution patterns.

PHYSIOLOGICAL FACTORS

1) Sex and Age

Sex and age are two very important parameters contributing to the identification of physiological states. Age is known to have a profound effect on the adaptability of the human (Bafitis, Sargent 1977), the most adaptable period of the human life cycle being around the late teens or early twenties. Resistance to hypoxia has been indicated in the elderly (Schwartz, 1936, Stupfel et al. 1975, Bruner et al. 1961) and related to a decrease in oxygen consumption with age. This may also hold true for ozone toxicity. There are different activity patterns with age. This can alter the pattern of air quality individuals are subject to.

2) Nutritional Status

Another important parameter possibly influencing ozone toxicity is nutritional status. High levels of Vitamin C (Matzen 1957), glutathione (Stokinger 1965) Vitamin E, Selenium and sulfer ion forming amino acids (Shakman 1974) have been implicated in the reduction of ozone toxicity. It must be remembered that the question of interest is not only to what degree is ozone toxicity affected by nutritional status but also how does ozone toxicity affect nutritional status.

3) Biological Rhythms

Circadian and circannual rhythms of physiological functions can influence penetration of ozone into the body, the sensitivity of target organs, pharmacokinetics, etc., and must be taken into account (Reinberg, 1976; Reinberg, Clench, 1976; Reinberg, Gervais 1972; Stupfel, 1975; Stupfel et al. 1977). Even though air pollution levels are highest in the summer, mortality due to certain diseases of the lung peak in January (Stupfel et al. 1977).

4) Temperature Stress

Temperature stress can be an important parameter influencing physiological states in the the Houston area. For those individuals using air conditioning, adaptation to the heat and humidity never takes place. Each time they go outside they subject themselves to heat stress.

5) Disease States

Disease states can alter the sensitivity to toxic agents and vice versa, toxic agents can increase susceptiblity to disease. Ozone increases susceptibility to bacterial agents (Coffin and Blommer 1967). In measuring the effects of pollutants it is necessary to include diseases of bacterial origin in morbidity. A question of interest is to what degree does infection affect ozone toxicity.

A disease of particular interest in the Houston area is allergy. Ozone has been shown to increase sensitivity to subcutaneous histamine in guinea pigs (Easton and Murphy 1967). This has huge remifications in a city having a high pollen count that has a higher than normal number of people suffering from histamine reaction. Not all people having allergic responses are aware of them as such. I personally think that a prime reason for so few calls being received in the Houston area complaining of health effects of pollution stems from an inherent confusion of whether or not it is an allergic response or a pollution effect. Many constituents of air pollution are water soluble. The effect of high pollution coupled with high humidity on skin allergies and even possibly on neoplasms of the skin would constitute interesting fields of study.

In estimating the influence of air pollution on the response to histamine, the circadian response of the human organism must be taken into account. Maximal response to histamine is around 23^{00}, well after the usual time for clinical observation of patients (Reinberg et al. 1969).

6) Miscellaneous

Other factors contributing to the physiological state of an organism that can influence ozone toxicity are smoking and variously induced states of anemia. Occupational exposure to other toxic substances (e.g. lead) can influence ozone toxicity (McClimans et al. 1978).

GENETIC FACTORS

Although genetic differences in sensitivity to ozone toxicity probably do exist, the identification of these genetic hyperreactors has not been stressed. Electrophoretic studies of the enzymes important in ozone detoxification followed by studies of the enzyme kinetics of the electrophoretically determined variants would be of interest in the two groups: 1) hyperreactors and their siblings and parents, and 2) non-reactors and their siblings and parents.

OVERVIEW

In trying to establish the lowest ozone levels tolerable to human health, the physiological response most sensitive to pollutant levels (e.g. possibly eye irritation) should be studied in the most "at risk" population.

In studying the effects of chronic exposure several phenomena must be kept in mind. It has been suggested that adaptation may have occurred in the Los Angeles as compared to the Canadian populations. (Hackney et al. 1977). However, in both acclimatization and adaptation, the organism may show a greater ability to tolerate a certain level of aggression but may not have the ability to adapt to levels over and above the adapted levels. For example increased erythropoiesis is an adaptive response to hypoxia and is evident at altitude. However, if smoking leading th higher CO in the blood is superimposed on altitude hypoxia, the disease polycythemia results in many cases. In this case, if adaptation to chronic air pollution doe in fact occur, is the organism's ability to respond to sudden acute episodes or other toxic agents altered?

Having briefly outlined the spectrum of ideas I consider important to consider in a proper evaluation of the health effects of air pollution, I will proceed to a more specific commentary on the Guideline to Contracts and Grants - Section D -12 and 13.

1. Effect of Short-term Exposure to Texas Gulf Coast Air Pollution in Ill and Healthy Persons.

Choice of Subjects

Several problems came to my attention when evaluating the EPA guidelines to contractors. I do not think asthmatics should be excluded, although I do feel that they should constitute a separate study group. I do not think children under 15 should be excluded since children suffering from asthma or COLD may be the most sensitive to air pollution. What kind of medical exam will be given? What parameters explored? A simple questionnaire is hardly enough. I think a greater diversity of disease situations should be chosen. Why not select a population of known hyperallergic individuals as revealed by hypersensitivity testing. There are several allergy clinics in the city that could provide such individuals.

You indicate that the final count of panalists will include 100 COLD (Chronic Obstructive Lung Disease) panalists and 200 control panalists. However, you have not clearly defined how many categories of indivudals will be examined. For example how may stations will be used?, how many age groups?, how many socio-economic classes? how many occupational categories?. I would calculate 1) at least three stations, 2) at least 4 age groups (6-15, 16-30, 36-45, 46 +), 3) two sexes, 4) three socio-economic classes (poor, middle and wealthy) and at least four occupational categories (indoor office, indoor home, outdoor, and industrial). This comes to a total of 16 categories. You should have at least 10 - 15 individuals per cateogory totalling 160 to 240 individuals in each study set, COLD and control. By my count you have too few subjects.

Environmental Conditions

Eight months is too short a period. The underlying assumption is that the greatest effect of air pollution will accompany the highest environmental levels. This need not be the case, should susceptibility be higher at another period. As I have indicated before, mortality due to lung disease is highest in winter while pollutant load is highest in summer. If the lowest environmental levels of air pollution are in the winter and infections are highest at that time, this could lead to higher susceptibility. There are seasonal rhythms of susceptibility (Momiyama 1977). It would, in my opinion, be better to have readings every other month or even preferably every two weeks over a 12 month period, with possibly extra readings right around the period of peak pollution levels.

You indicate many questions on heating systems, type of fuel, etc. However, there is not a word about air conditioning. Air conditioning is an important part of Houston living both in motor vehicles and in homes. However, it is also a function of socio-economic status. The poor either do not use them or have poorly functioning ones. Similarly even though a person indicates that he is a non-smoker, he may have a heavy smoker in the home or office. This should be noted.

Occupations can lead to varying exposures to air conditioned or filtered air. Even if air pollution levels are highest in the summer, actual exposure may be higher in the winter in certain professions.

I do not know the answers to these questions. I am merely indicating that these questions exist and should be addressed.

Measuring at the same time each day for a given individual does not remove the circadian effect from the total data. The hour of the test should be noted and a comparison made between tests done at different hours of the day. Peopl sensitivity to drugs (Reinberg, Clench 1976), histamine and allergens (Reinberg et al. 1969) varies significantly over the 24-hour period. Tests should be run to establish this hour of maximum sensitivity to each component of air pollution. Subsequently tests should be run both at times of peak concentration and peak sensitivity.

To decrease sample size separate studies could be run to progressively single out the most susceptible population group. I would suggest one experiment run on a homogenous (in age, sex and health status) group to determine the hour of peak sensitivity (using 10 to 15 individuals). This should be followed by a series run on at least four age groups of only one sex (at the peak sensitivity time) to establish the most vulnerable age group. A separate study on populations exposed versus not exposed to air conditioning could be run to see if this in fact complicates the issue.

Once the most vulnerable population has been isolated, than a complete series of pulmonary function tests could be run on that group. However, it would be of interest to study a larger population as well using self-measurement and continuous monitoring devices. For example, peak flow could be measured by the Wright Peak Flow Meter (Airmaid, England). MEDILOGS (Ambulatory Monitoring Instruments, Ardsley, N.Y.) can measure such parameters as heart rate (an indicator of exercise), skin temperature (an indicator of whether the individual is indoors or outdoors) and chest expansion. There is a whole battery of measurements that can be done by the individual such as time to add a series of random numbers, auto-estimation of fatigue, oral temperature, a test of dexterity etc. These could be included in an inexpensive (cuts down the need for experimentors) and usually well received longitudinal study that would ennable a direct comparison with air pollution readings at any given hour.

2 Effect of Exposure to Texas Gulf Coast Air Pollution in Maximally Exercising Healthy Persons.

It should be recognized, that this study, although of interest has severe limitations. By selecting young presumably male athletes you are selecting the population that is possibly the most able to adapt to environmental challenges (Bafitis, Sargent 1976). A measured effect in this sample may indicate that another more vulnerable population will show an even greater effect. No effect does not indicate that another population would not reveal an effect. These reservations in mind, pass to specific comments in the suggestions to contractors.

Choice of Subjects

I do find it dangerous to rely on questionnaires in determining health status in this population. The individuals are young, less knowledgable about their own health and probably very reluctant to release information that may in their minds jeapordize their position in the cross-country team.

Environmental Conditions

As much data as possible should be gathered. Hourly averages over the 24-hour span should be indicated. Air quality information both within the school and within the home should be acquired. The environmental information that should be gathered is : temperature (averages and hour by hour), humidity (similarly averages and hour by hour), 24-hour air-pollution averages for each of the major pollutants as well as peak values and time peak.

May I suggest the use of continuous monitoring devices (again measuring heart rate, skin temperature, and lung expansion) during the events themselves.

This paper has not been an attempt either to review the literature or to present a protocol. It is given merely as an indication of where I feel there are weak points, and why I think these may be important to consider. I do not think the study is specific enough to Houston and Houston's problems. I am aware that to do all that I suggest would be prohibitively expensive. I do think it is possible to take into consideration some of the suggestions however.

I should also add that the problem of the interraction of various chemical pollutants needs looking into. I would presume that animal work is currently going on to determine the carcinogenic, teratogenic and toxicologic effects of the individual pollutants and different chemical combinations of them. This is another phase of the research effort and I will not dwell on it here.

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CURRICULUM VITAE

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EDUCATIONAL BACKGROUND:

University of Texas - School of Public Health at Houston 1976 - present

Ph.D. Candidate
Area of Specialization - Human Ecology
Degree Expected -March to June 1979
Course work included :

- Biochemical Nutrition
- Environmental Physiology
- Physiology of Work
- Cellular Metabolism
- Intermediate Statistics
- Mathematical & Computer Methods in Time-Series and Geographical Analysis
- Bioclimatology
- Abiotic Environment
- Waste Management
- Hydrology
- Ecology
- Behavior and Adaptation
- Evolution
- Toxicology

Thesis topic: Characterization of Red Cell ATP and 2,3-DPG as a Function of Altitude, Time, Genetic Structure, Sex, Age, and Environmental Lithium levels.

University of Paris VI 1971 - 1976

"License" in Animal Physiology in 1972
"Maitrise" (equivalent to Masters of Science) in Zoology in 1974
Course work included :

- Biochemistry
  - Lipids
  - Proteins
  - Carbohydrates
  - Enzymes
  - Intermediary Metabolism
  - Nucleic Acids
- Neurophysiology
  - The Nerve Cell
  - Motor Reflexes I & II
  - The Vestibular System
  - The Sensory System
  - Receptors
- Animal Physiology
  - Physiol. of the Nervous System
  - Physiol. of the Cardiovascular System
  - Physiol. of the Circulatory System
  - Physiol. of the Renal System
  - Endocrinology
  - The Axon
- Physiological Psychology
  - The Ear
  - The Eye
  - Ethology
  - The Limbic System
  - Major Pathways of the Motor & Sensory Systems
  - Homeostatic Regulation
  - Photoperiodicity

Ph.D. Candidate
Area of Specialization - Human Physiology
Degree expected - Fall 1978

Thesis title: The circadian chronopharmacology of ethanol, Indomethacin and sodium salicylate in healthy Man.

University of California - Santa Barbara 1967 - 1971

B.S. in Zoology

WORK EXPERIENCE:

University of Texas - School of Public Health 1977-1978
Graduate Assistant for Dr. Frederick Sargent II
1) Worked on preparing course material on land use and migration in Latin America
2) Did research on the Changing Adaptability over the life sequence of the human female.

Equipe de Recherche - C.N.R.S. -sur la Chronobiologie Humaine
under Dr. Alain Reinberg 1971 - 1977
Research Assistant
1) Circadian chronopharmacology of Ethanol in presumably healthy male adults. (Funded by the D.R.M.E.)
2) Circadian chronopharmacology of Indomethacin in presumably, healthy Man. (Funded by Merck, Sharpe & Dohme)
3) Circadian chronopharmacology of sodium salicylate in Man.
4) Circannual variations of leucocytes, total proteins and immunoglobulins in presumably healthy young adults.

Tasks involved :
writing protocols; organizing research program; administrating and actual running of experiment; analysis of raw data; treatment by both conventional statistical analysis and by sophisticated computer programs; writing of papers, etc.

University of California - Santa Barbara 1969 - 1971
Institute of Environmental Stress under Dr. Steven Horvath
Work Study
Laboratory Technologist with special emphasis on blood gas physiology.

MEMBERSHIPS: International Society for Chronobiology; AAAS.

PUBLICATIONS:

1) Reinberg, A., Schuller, E., Delasnerie, N., Clench, J., Hedary, M., (1977) - Rythmes circadiens et circannuelles des leucocytes, proteines totales, IgA, IgG, IgM d'adultes jeunes et sains. (Circadian and circannual rhythms in the blood (leucocytes, total proteins, IgA, IgG, and IgM) of young healthy human adults.) Nouvelle Presse Medicale

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3) Reinberg, A., Clench, J., (1976) - Progress in Human Chronopharmacology. Et Al. 4(1):58-60.

4) Clench, J., Reinberg, A., Ghata J., Dupont, J., (1975) - Chronopharmacologic effects of Indomethacin in healthy young human subjects. Chronobiologia Suppl, 1:14-15.

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6) Reinberg, A., Clench, J., Ghata, J., Halberg, F., Abulker, Ch., Dupont, J., Zagula-Mally, Z., (1975) - Rythmes circadiens des parametres de l'excretion urinaire du salicylate (chronopharmacocinetique) chez l'homme adulte sain. Comptes-Rendus Acad. Sc. Paris. 280:1697. (Circadian rhythms of the parameters of the urinary excretion of salycilate (chronopharmacokinetics) in the healthy adult man.)

7) Reinberg, A., Clench, J., Aymard, N., Gaillot, M., Gervais, P., Abulker, Ch., Dupont, J., (1974) - Rythmes circadiens des parametres de l'ethanolemie provoquee chez six hommes adultes jeunes et sains. C. R. Acad. Sc. Paris. 278:1503. (Circadian rhythms of the parameters of induced ethanolemia in six healthy young adult males).

References and transcripts will be furnished upon request.

Jocelyne Clench-Aas

CIRCADIAN CHRONOPHARMACOLOGY OF ETHANOL, INDOMETHACIN AND SODIUM SALICYLATE IN HEALTHY ADULT MAN

ETHANOL

Six healthy young men (22 to 26 years) who had fasted for 12 hours volunteered for this study (subject synchronisation: diurnal activity from 0700 to midnight and nocturnal rest). A set dose of ethanol (0.67 g/kg body weight) was ingested at the fixed (and random) hours of 0700, 1100, 1900, and 2300, with a week between tests.

A set of physiological variables: psychological tests (self-rating of mood, of physical vigor and of ebriety, tempo, random number addition tests); physical variables (heart rate, systolic and diastolic blood pressure, peak expiratory flow, oral temperature and grip strength); blood variables(plasma ethanol, cortisol. lactic acid, pyruvic acid, glucose and erythrocyte K^+) and urinary variables (volume, epinephrine, nor-epinephrine, and 5-HIAA) were documented at least at 4 hourly intervals and set times. The cosinor method was used for chronobiological statistical analyses.

The parameters characterizing the ethanol pharmacokinetics (chronopharmacokinetics) demonstrated a circadian rhythm ($p<0,05$); e.g. the peak height of ethanolemia is greater when ethanol is ingested at 0700 than at other times.

Also a circadian rhythm in biosystems susceptibility can be demonstrated ($p<0.05$)(chronesthesy) with a peak time not necessarily corresponding either to that of ethanolemia or to that of other variables.

The overall circadian changes in ethanol effects (chronergy) can be viewed as a combination of both ethanol chronesthesy and chronokinetics.

FROM: Reinberg, A.,Clench,J.,Aymard, N., Galliot, M.,Bourdon, R., Gervais, P., Abulker, Ch., Dupont, J., Variations circadiennes des effets de l'ethanol et de l'ethanolemie chez l'homme adulte sain. Etude chronopharmacologique. J. Physiol., Paris, 1975, 70: 435-456.

INDOMETHACIN

Nine subjects (19 - 29 years) including two females were studied from Nov. to Feb. Subjects synchronisation: diurnal activity (0700 to 0000) and nocturnal rest. A single dose (100 mg) of Indomethacin was ingested at each of the 5 different fixed test times, one week apart (Saturday-Sunday). The fixed clock hours were: 0700, 1100, 1500, 1900 and 2300. The test order was randomized. Test duration was 28 hours. Eleven physiological variables were documented (post absorption) at intervals $\Delta t=0.5$, 1.0, 1.5, 2.0 and 4.0 hrs thereafter, as well as 2 hourly testing done on a control day.The variables measured were: self-rating of mood and fatigue, heart rate, systolic and diastolic blood pressure, oral temperature, grip strength, joint size, eye-hand skill, random number addition test and capillary resistance. Venous blood was sampled at; 0, 0.33, 0.67, 1.00, 1.50, 2.00, 4.00, 6.00, 8.00 and 10.00 hrs from ingestion time. The spectrophotofluorometric method of L. A. Grabowski was used for plasma Indomethacin determinations. The pharmacokinetic agent was characterized by: the peak of the plasma concentration (peak height), the span of time to reach this peak (time to peak) and the area under concentration/time curve (area). Both conventional and single cosinor methods were used for statistical analyses.

INDOMETHACIN cont.

The mean cosinor analysis showed that a statistically significant rhythm ($p < 0.05$) was validated: 1) on the control day and 2) when Indomethacin was ingested at 1900 and/or at 2300 for the following variables: self-rating of mood and fatigue, heart rate, systolic and diastolic blood pressure, oral temperature, grip strength, joint size, eye-hand skill, random number addition test.

A circadian rhythm of the peak height was validated ($p < 0.005$) with mesor M=5.21 ugm/ml; amplitude A (as % of M) = 23.2 (from 14.6 to 31.7); acrophase Ø (midnight as Ø reference) = 08.52 (from 0706 to 1037). A circadian rhythm in the time to peak is validated as well ($p < 0.005$) with: M = 129 minutes; A (as % of M) = 31.8 (from 20.2 to 43.4); Ø = 20.13 (form 1834 to 2200). The area does not show a circadian variation. Thus the ingestion of Indomethacin around 1900 is associated with: 1) the smallest peak height and the longest time to peak. This may help explain the findings of the physiologic variables that indicate that the subjects's temporal structure is not altered by an evening ingestion and more or less perturbed by a morning one. Indomethacin induced changes (expressed as individual ratios: measurements at T_0 + 4hrs/ those on corresponding clock hours on control day) also show statistically significant circadian rhythms for most of the studied variables. Evening ingestion of the drug seems to be less disturbing, despite some undesirable effects (e.g. capillary resistance, addition test) found in a few variables.

FROM: Clench, J., Reinberg, A., Ghata, J., Dupont, J., Chronopharmacological effects of Indomethacin in healthy young human subjects.
AND: Clench, J., Reinberg, A., Dziewanoska, J., Ghata, J., Dupont, J., Chronopharmacokinetics of Indomethacin in 9 healthy young human adults. Chronobiologia 2(suppl. 1):26 and 4(2):22. 1975 and 1977 respectively.

SODIUM SALICYLATE

A solution containing 1 gm of crystallized sodium salicylate was ingested in four separate tests at least one week apart, by six volunteer healthy adults at each of the following test times: 0700, 1100, 1900 and 2300. The subjects had been on a routine of diurnal activity with lights on from 0700 to 2300 and collected urine at four-hourly intervals for 48 hrs following drug ingestion. By the mean cosinor summary of least squares fits of a 24 hour cosine curve, or by other testing, a within day difference is established for several chronopharmacokinetic parameters characterizing urinary salicylate excretion. By criteria including the height of peak excretion, the span necessary to reach the peak, etc., it is shown that as compared to drug administration at other times, salicylate is excreted faster into the urine, reaches higher values sooner and is falling off faster when the drug is ingested between 1900 and 2300.

FROM: Reinberg, A., Clench, J., Ghata, J., Halberg, F., Abulker, Ch., Dupont, J., Zagula-Mally, Z., Rythmes circadians des parametres de l'excretion urinaire du salicylate (chronopharmacocinetique) chez l'Homme adulte sain. C.R. Acad. Sc. Paris, t. 280 (14avril 1975)

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Prepared Comments
on the
TEXAS GULF COAST STUDY PLAN
on the
AIR POLLUTION RESEARCH PROGRAM
for the
U.S. ENVIRONMENTAL PROTECTION AGENCY
under the
CONTRACT NO. 68-02-2955

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INTRODUCTION

Purpose

The U. S. Environmental Protection Agency is preparing to conduct a detailed three year study of air pollution and related health effects problems along the Texas Gulf Coast. The three million dollar study program will be administered by the Radian Corporation, which is responsible for developing a detailed study plan. The first phase of the plan development process involves an identification of specific research needs and capabilities by local organizations. The present study was mandated by passage of the recent 1977 Amendments to the Federal Clean Air Act.

The purpose of the contract is to develop base and perform analyses of air quality along the Texas Gulf Coast. The study is to be composed of specific topics relating to literature review, emission characterization, regional meteorology, pollutant nature, fate and control. The ultimate purpose of the study is to provide a suitable data base for understanding the unique air pollution characteristics of the Texas Gulf Coast. The information developed in the study can then be used as a basis for an air quality management plan for assisting the Gulf Coast area to comply with Federal air qulaity requirements while maintaining a healthy economy.

Problem

The Texas Gulf Coast is the center for the nation's petroleum and petrochemical industries, with approximately 25% of the National refining capacity and over 40% of its petrochemical production. The Houston-Galveston metropolitan area is the nation's most energy-intensive urban region, and account for almost three percent of the nation's total energy consumption. The Beaumont-Port Arthur and Corpus Christi-Point Comfort metropolitan regions are also very energy-intensive in a manner far out of proportion to their populations. The Houston-Galveston metropolitan region is also the nation's fastest growing metropolitan area in terms of population, because of its healthy economic stituation, with a growth rate exceeding 2,000 persons per week.

The Houston-Galveston metropolitan region is presently classified as a nonattainment region in terms of Federal primary ambient air quality standards for photochemical oxidants and particulate matter. This designation as a nonattainment region has resulted in the necessity for the area to implement the emission offset policy, where no net increases in the designated air pollutant emissions for the region would be allowable. In addition, prevention of significant deterioration requirements would severely restrict the siting of new industrial facilities in the region. Air quality requirements will also mean that significant reductions in air pollutant emissions will also be necessary from transportation sources. Serious conflicts between air quality and economic growth will result unless rational air pollution control strategies are developed for the Texas Gulf Coast.

SITUATION

Energy Usage

Texas is the nation's largest producer of energy resources with just over 10% of the total energy production. Texas produces 35% of the nation's oil and 37% of its natural gas. Texas is also becoming a major coal-producing state, with 14 million tons of low grade lignite coal produced in 1976. Total lignite coal production in Texas is expected to reach 58 million tons per year by 1985. This lignite, along with an estimated 40 million tons per year of Western coal, will mean that Texas will be using almost 10% of the desired national total under the National Energy Plan.

The Texas Gulf Coast is the most energy-intensive region of the country, and constitutes approximately five percent of the national total energy use. Conservative projections of increased coal use in the Houston-Galveston metropolitan area indicate that nine million tons of coal will be used in the industrial sector by 1985, partially as the result of Texas Railroad Commission Docket No. 600. In addition, an estimated ten million tons per year of coal will be burned for electric power generation in the Houston-Galveston metropolitan area by 1985. If all possible applications for coal use in the industrial, utility and transportation sectors were converted, the total coal use in the Houston-Galveston region would exceed 150 million tons per year.

The energy goals mandated by the Texas Railroad Commission under Docket No. 600 on natural gas phaseout and by the U. S. Department of Energy, under the coal conversion provisions of the forthcoming National Energy Act will be in direct conflict with some of the air quality goals in the recently enacted Federal Clean Air Act. The present study needs to address the air quality impacts of these energy goals in terms of emission control requirements,projected air quality levels of aerosols and gaseous, and potential health effects. The overall question of energy facilities siting for industrial, utility and transportation uses needs to be a part of the present study in terms of urban versus nonurban siting and concentrated versus dispersed siting.

Emission Trends

Previous studies of the impact of the above-mentioned increased coal utilization on air pollutant emissions in the Houston-Galveston metropolitan region have been made by the University of Texas at Austin. Particulate matter emissions resulting from increased coal combustion in the Houston-Galveston region are expected to reach 13,700 tons per year by 1985, or 11% of the 1973 Region 7 total. Sulfur oxides emissions from increased coal combustion in the region are expected to be between 128,000 and 224,000 tons per year by 1985, an increase of 66 to 115% of the 1973 Region 7 total. Nitrogen oxides emissions from increased coal combustion alone are estimated as 172,000 tons per year, or 58% of the 1973 Region 7 total.

The above calculations presume the primary use of low sulfur Western subbituminous coal as the predominant fuel in the Houston-Galveston region. The significant use of the higher sulfur Eastern coals and Texas lignites would greatly increase the estimated air pollutant emissions in the region, especially for sulfur oxides. The problem would be especially great for large scale use of high sulfur bituminous coal in onsite industrial stoker-type boilers in existing industrial plants immediately upwind of populated areas.

Several air quality impacts may result from the proposed increased use of coal along the Texas Gulf Coast. Particulate burdens in the atmosphere will increase because of increased primary fly ash and secondary nitrate and sulfate aerosol contents, which may result in reduced visibility and increased health-related impacts. The increased sulfate and nitrate aerosol contents resulting from the greater sulfur oxides and nitrogen oxides emissions will aggravate acid rainfall in the area to the detriment of material surfaces, drinking water quality, aquatic and marine life. The increased nitrogen oxides emissions may alter the photochemical reaction mix of hydrocarbons-to-nitrogen oxides, with possible changes in reaction product distribution and reaction rates.

Local Uniqueness

The Texas Gulf Coast has several unique characteristics which make it different from other metropolitan regions in terms of air quality considerations. First, the area has a relatively high relative humidity level which tends to enhance heterogeneous gas-liquid reactions on the surfaces of particles. As a result, sulfate and nitrate-production are encouraged by catalytic reactions of nitrogen and sulfur oxides. The relative predominance of first or second order reaction mechanisms is still an unresolved research question.

The second unique feature of the Texas Gulf Coast region is the high reaction ratio of hydrocarbons-to-nitrogen oxides in photochemical atmospheres. The result is to encourage the formation of aldehydes and epoxide aerosols at the expense of peroxyacyl nitrates, nitrosamines and nitrate aerosols. As a result, nitrogen oxides may prove to be the limiting reactant in the photochemical atmospheres. Significant increases in nitrogen oxides concentrations may alter reaction rates and reaction products. The presence of substantial hydrocarbon concentrations may accentuate the oxidation of sulfur oxides and nitrogen oxides to organic-based sulfate and nitrate aerosols.

RECOMMENDATIONS

A number of specific recommendations need to be made as a part of the proposed study plan in the following areas.

B. Emissions and Resultant Air Pollution

1. Emission data will need to be gathered for organic compounds in terms of types and amounts of specific types of compounds in terms of photochemical reactivity. Nitrogen oxides and sulfur oxides emissions need to be categorized by source and amount. Particulate emission characterization needs to be made by source. Projections of all of the pollutants need to be made into the future for alternative industrial development and energy use scenarios. Of particular concern is to delineate the direct combustion of coal in new boilers in urban areas as compared to conversion to synthetic fuels outside of urban areas with subsequent combustion in urban areas in existing boilers.

2. The gathering of ambient pollutant concentrations should include the determination of the trace metal concentrations in particulate matter as a function of particle size. Of particular concern is to determine the cationic association of sulfate and nitrate aerosols.

3. The uniqueness studies of the Texas Gulf Coast should include the high relative humidities and the hydrocarbon-to-nitrogen oxides reactant ratios.

E. Pollutant Nature, Sources, Fate and Control

1. The studies on nature, sources and fate of aerosol pollutants should include studies of removal mechanisms including the resulting chemical composition of precipitation in terms of acid-producing and metallic constituents. The impacts of sulfate and nitrate aerosol concentrations on total particulate burdens need to be evaluated in terms of possible control strategy development. Baseline total suspended particulate levels need to be developed for sulfate, nitrate, trace metal, trace organic and radioisotope contents by mass concentration and particle size as a baseline for future coal and lignite utilization.

4. Air Quality Simulation Model Validation

Laboratory studies need to be performed of sulfur dioxide and nitrogen dioxide oxidation in highly humid atmospheres in the presence of hydrocarbons and particulate matter. Reaction rate constants need to be developed and suitable air quality models need to be developed. Photochemical models of sulfur dioxide and nitrogen dioxide reactions need to be developed and verfied through field and laboratory studies.

F. Local Agency Facilities

The University of Texas at Austin has laboratory and computer facilities which could be used for the proposed studies. The Center for Energy Studies at the University of Texas at Austin can enter into contractual agreements with the U. S. Environmental Protection Agency to carry out any specific research projects, either alone or in conjunction with other organizations. Research projects can be conducted both by laboratory and computer studies in Austin and on field projects in Houston or elsewhere.

The University of Texas at Austin
Environmental Studies Program
Center for Energy Studies
Austin, Texas

PROPOSALS

The Center for Energy Studies at the University of Texas at Austin is submitting two preliminary research proposals as a part of the Texas Gulf Coast Planning Study. These proposals are briefly described in the following discussions.

I. Title: Impact of Fuel Conversion Strategies on Emission Trends and Air Quality along the Texas Gulf Coast
Time: Two years (24 months)
Amount: $75,000
Person: R. W. Miksad

The impact of alternative strategies for fuel conversion ton coal and fuel oil is to be determined for several alternative energy scenarios by a computer modeling study. Projections of combustion-related emissions are developed for alternative direct combustion and synthetic fuels development. Air Quality impacts on sulfur and nitrogen oxides transformations in Gulf Coast atmospheres will be determined based on already developed atmospheric dispersion models. Control strategies can then be developed based on the results of the study.

II. Title: Chemical Characterization of Precipitation as a Pollutant Scavenging Mechanism along the Texas Gulf Coast
Time: Three Years (36 months)
Amount: $130,000
Person: H. B. H. Cooper

The chemical composition of precipitation in the Texas Gulf Coast region is to be determined in terms of acid-producing, trace metals and organic compounds as a scavenging mechanism and a potential water quality problem by a field study. The buffering capability of particulate matter and ammonia in Gulf Coast atmospheres will be determined as an offset to sulfate and nitrate-bearing acid components. Time and space variations in chemical composition of precipitation will be established to develop baseline data in terms of emission trends for the future, as well as to establish the basis for control strategy development.

ADDITIONAL REFERENCES SUBMITTED

Prepared Testimony on the POTENTIAL FOR INCREASED COAL UTILIZATION IN THE STATE OF TEXAS. Submitted by: Hal B. H. Cooper, Jr., University of Texas at Austin, Austin, TX. Presented to: Railroad Commission of Texas, June 20, 1978.

NATIONAL ENERGY POLICY: A CONTINUING ASSESSMENT, January 1978. Council on Energy Resources, The University of Texas at Austin.

TEXAS RESEARCH NEEDS IN AIR POLLUTION CONTROL, Texas Air Control Board, Austin, TX, April 1977.

A METHOD OF INCLUDING SECOND-ORDER OXIDATION OF SO_2 IN AN URBAN AIR QUALITY MODEL. A. R. Laird, Atmospheric Sciences Group, Center for Energy Studies University of Texas at Austin, Austin, TX, January 15, 1978.

AN APPLICATION OF A PSUEDO-SECOND ORDER SO_2 REACTION ALGORITHM TO URBAN AIR POLLUTION MODELING. A. Rachel Laird and Richard W. Miksad, College of Engineering, University of Texas at Austin, Austin, TX. Presented at 71st Annual Metting of the Air Pollution Control Association, Houston, Texas, June 25-30, 1978. Accepted for publication in The Journal of the Air Pollution Control Association, 1978.

OBSERVATIONS ON THE PARTICULATE CHLORINE DISTRIBUTION IN THE HOUSTON-GALVESTON AREA. A. R. Laird and R. W. Miksad, Atmospheric Science Group, University of Texas, Department of Civil Engineering, Austin, TX, December 1, 1977.

CHEMICAL COMPOSITION OF ACID PRECIPITATION IN CENTRAL TEXAS. Hal B. H. Cooper, Jr. and Jose A. Lopez, University of Texas at Austin, Austin, TX and Jerry M. Demo, Texas Air Control Board, Austin, TX, May 26, 1976.

AN EVALUATION OF THE RESTRICTIVENESS OF TEXAS AIR CONTROL BOARD REGULATION V ON CONTROL OF VOLATILE ORGANIC COMPOUND EMISSIONS FROM PETROLEUM STORAGE AND OTHER FACILITIES. Michael L. Magee and Hal B. H. Cooper, Jr., Center for Energy Studies, The University of Texas at Austin, Austin, TX, Environmental Study No. 1, June 1978.

Faucette, James R.
Chairperson
Air Quality Committee
Galveston Bay Conservation and Preservation
Association

Galveston Bay Conservation and Preservation Associatic

PO Box 323 Seabrook, Texas 77586

October 2, 1978

Mr. Gary Tannahill
Program Manager
Radian Corporation
8500 Shoal Creek Blvd.
Austin, Texas 78766

Dear Mr. Tannahill:

As chairperson of the Air Quality Committee of the Galveston Bay Conservation and Preservation Association, I want to thank the Environmental Protection Agency and the Radian Corporation for the letter received by us, dated August 29, 1978, and inviting us to participate in the project on air pollution and related health problems in the Texas Gulf Coast area. Let me say to you that I am representing a sizeable group of citizens about 400 of whom are organized into a dynamically active volunteer citizens organization. The concerns expressed here are intended to have in mind the well-being of citizens and residents.

First, it would be helpful to have some clarification as to the intent, direction, and scope of the project as summarized in the August letter. The mandate from Congress seems to clearly focus on two matters of utmost importance to many citizens who reside in this area: (1) Attention/research of health problems and the health effects of air pollution; and (2) the cooperative participation of local groups in the project. In the August letter the reference to the scope of the project is ambiguous in saying that "among other tasks, we are collecting information on air pollution and its health effects in the Texas Gulf Coast region...". The ambiguity arises from the reference to "among other tasks" and it would be important to know what are the other tasks referred to in that statement. The task mandated seems to be the single, and sole task involved in the project. We would want that kind of concentrated effort and feel that the singleness of purpose in understanding the health effects of air pollution in the area merits full attention. If the money and effort is to be directed to other tasks then these need to be explained. The matter is raised only because we would not want to have the results of this important work diluted. We need thorough and accurate results which can help people from the various sectors of interest in this area make decisions which can be based on valid and solid information. Regarding the second matter on the mandate we would understand this to mean an ongoing opportunity to participate and not just a one-time opportunity at the meeting in October. We request that in addition to this informal meeting another meeting be held at which time a progress report be made and another opportunity for assessment and input be given interested area groups.

It is necessary for us to raise questions about the contracting between E. P. A. and the Radian Corporation. The mailing address of 8500 Shoal Creek Blvd in Austin places them in close proximity to the Texas Air Control Board at 8520 Shoal Creek Blvd. This location leaves us needing assurances of the corporations' autonomy and their objectivity in conducting the study. To what extent will they be influenced by the Texas Air Control Board? It is important that this study be contracted for so as to assure professional independency, autonomy, objectivity, and competency. Who are the health experts with this corporation by position or in consultation for this study?

Another matter we write to ask about has to do with the absence of any indication at this point as to how you plan to collect data. What are going to be the building blocks for your data base? It is important and necessary that you establish your separate monitoring system in order to provide comparative data and in order to fill in gaps where the kind of data needed is not available.

Now, for a response to the three page exhibit A on the scope of work. This design is one-sidedly emphasizing the technical aspects of certain air pollutants and there is not enough definition given to the health effects aspect of the study. There is inadequate reference to available and known health effects data which would be germaine and essential to the study. The design thus far does not indicate that there is to be a well-balanced integration of technical air pollution data and scientific health effects data. Then, of course, for the study to be useful it must be applicable and practical. Some concerns are:

> It is essential to give much attention to the specific, known, suspected, and potential carcinogenic and mutagenic agents as well as chemical agents or properties capable of chromosomal damage. These should be listed and studied in terms of isolated and cumulative or combined effects. There is a definite need for studies to be applied related to the long term effects of low level exposures. Available information needs to be compiled so as to pin-point sources and emission levels of the potentially harmful sources of air pollution and then this information collated with the location and dwelling of people and related health effects. Consideration needs to be given to short term, critical upset, and long term effects with the dormancy threat. The distinction between community/residential exposures for 24 hours a day and the worker exposure of 8 hours a day needs to be applied to the study in determining the effects of pollutants and the possible safe levels of any exposure in an area where people reside.
>
> Definitive studies are needed on the effects of SO^2 and the issue of converting to coal from natural gas for the Houston area. Specific attention needs to be given to particular respiratory health problems and air pollution. Several recent public hearings by the Texas Air Control Board highlight some of the basic health concerns and issues which were raised by citizen organizations and municipalities. We invite your attention to the transcript of the proceedings of Public Hearing 114 and 116, and are available to help locate the information within these records. Numerous references on the health affects of air pollution can be found in those records.

I summarize our concern with an illustration. We want the study to be conducted in such a way so that even if the results were to justify placing a notation on the sales contract of a house in an area of pollution which states: "breathing the contents of the air in this location over an extended period of time could be injurious to your health", those results will be available for consideration by the public and all persons concerned.

Sincerely yours,

James R. Faucette

James R. Faucette, Chairperson
Air Quality Committee

JRF/oh

Mannchen, Brandt

October 3, 1978

Possible Areas for Research on Air Pollution in the Houston Region

1.) What SO_2 control strategies exist today (FGD, burning of low sulfur coals, burning of natural gas, FBC, coal cleaning before combustion, etc.) and how do these strategies compare in economic costs, environmental costs (are they throw away or regenerable systems), what saleable by-products can be recovered, technological feasibility, reliability, efficiency, and maintenance (cost and ease of repair or maintenance)? What future control strategies look promising? These questions should be addressed with the fuel switch over from natural gas and fuel oil to coal in mind and the scale, magnitude, and the nearness of implementation.

2.) There should be an indepth review of the emissions from the internal combustion vehicle and its contribution to the total air pollution problem in the Houston area. This is especially true with the tremendous growth that is occurring here and the 100's of new automobiles that come to Harris County every day. The question of control strategies (additional emission control devices (kinds and costs) or transportation controls (kinds and costs)) should also be addressed.

3.) The Ozone problem in the Houston area should be studied with particular emphasis on the natural background and transport levels, Ozone formation and the formation of other photochemical oxidants including haze, the monitoring and the study of other oxidants for the possilbe replacement of Ozone as the indicator of oxidant levels, the importance of Hydrocarbons and Nitrogen Oxides and other factors in the formation of Ozone and other oxidants, controls necessary to reduce undesirable concentrations.

4.) The synergistic effects of air pollutants in the Houston area. Especially addressing the number of different air pollutants and the difficulties of the early warning problems for health effects, the individual health effects (what concentrations cause problems, thresholds if there are any), carcinogens, teratogens, mutagens, respiratory illnesses, etc.), how these pollutants interact with each other (whether they combine to form more toxic, less toxic, or secondary pollutants).

5.) Epidemiological studies on populations in the vicinity of different major industrial plants or in the path of their plumes and how their rate of cancer, birth defects, mutations, respiratory diseases (health effects in general or specific health effects) compare with areas not in close proximity to such industrial complexes or their plumes. The economic cost of the pollutants on the victims and their property losses and on society as a whole and which if any socioeconomic or age group is most likely to be affected (aged, children, minorities, wealthy, athletes, etc.). The effects that pollution is having on vegetation and various materials.

6.) What is the magnitude of odor pollution in the Houston area and what abatement strategies or control equipment are available or need to be developed to reduce this problem?

7.) What will be the amount and the effect of an increased amount of trace metals, radioactivity, Nitrogen Oxides, and particulates from the increased burning of coal? The problem of increased acid rainfall in the Houston area from the burning of coal.

8.) What are the health effects of small particle, particulate, and aerosols and the control strategies and monitoring capabilities for abating these pollutants? The problems of increased Sulfites should be examined since there will be increased coal burning.

9.) Additional monitoring studies in undeveloped areas of the Houston Region to determine how much the ambient levels of air pollutants increase (is there significant deterioration) after residential development occurs.

To: Gary K. Tannahill
Radian Corporation
8500 Shoal Creek Blvd.
Austin, Texas 78766

From: Brandt Mannchen
4055 South Braeswood # 303
Houston, Texas 77025

Marrack, D., M.D.

420 Mulberry Lane
Bellaire, Texas 77401
October ,1978

Radian Corporation
8500 Shoal Creek Blvd.
P.O.Box 9948
Austin, Texas 78766

Dear Sir:

COMMENTS ON POSSIBLE AREAS OF RESEARCH IN THE HOUSTON AREA ON AIR POLLUTION

1) Give additional support to the U. of T. M.D.Anderson Hospital and Tumor Institute - Epidemiology Department's studies on cancer distribution in H-GAC Area and adjacent areas as needed for effective objectivity.

2) Establish a grid of not less than 20 low-level-concentration Halogenated (especially chlorinated) Hydrocarbon, Polycyclic Matter (POM & BaP) air pollution detectors about the ship channel industries and on the N.W. - S.E. extensions of this area. These detectors to operate 24 hrs. a day 365 days/yr. on a continuous basis or on repeated sampling at not less than 10 min. period samples.

3) Extend through using larger samples of population and in conjunction with concurrent 24 hour Air sampling

   a) Particulates less than 1 diameter and those greater than 1.0 and up to 100 diameter particles size

   b) NO_x , SO_x

   c) Ozone. PAM, etc.

   of respiratory illnesses in adults and school children in the manner done by Dr. Dan Jenkins, Dept. Pulmonary Disease, Baylor College of Medicine, Houston.

4) Establish an atmospheric chemistry research program for the Air of the Gulf Coast industrial area to determine the dynamics of air pollution chemistry by day and night for the area, the products produced;

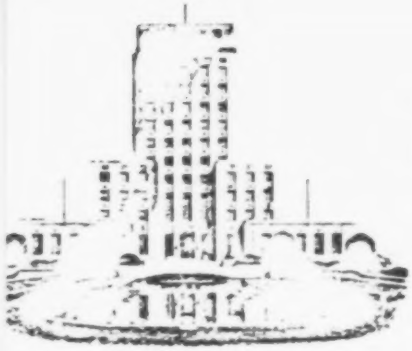
their half lives and their respiratory and other biological effects.
5) Determine the quantities of Asbestos and fiberglass particles less than 1 diameter in the Houston air by sampling programs.
6) Establish and operate on a 24 hr. basis mobile air sampling systems to track air pollutant releases from ship channel and other plant excursions, malfunctions and start up and shut down operations.

Thank you for the opportunity of partcipating in your hearing and for the inclusion of this in your report.

Yours sincerely,

D. Marrack,M.D.

McKee, Herbert C.
Assistant Health Director
for Pollution Control
City of Houston



City of
HOUSTON
JIM McCONN, MAYOR
HOUSTON, TEXAS 77001

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CONTROLLER
KATHRYN J. WHITMIRE

October 9, 1978

Mr. Gary Tannahill
Program Manager
Radian Corporation
P. O. Box 9948
Austin, Texas 78766

RECEIVED
OCT 12 1978

Dear Gary:

At your public meeting on October 3 to aid in planning for the Houston Air Pollution Study, you mentioned that you would like to have information from the City of Houston documenting our reservations about the oxidant standard and control requirements to achieve that standard. In a brief period of time, the only thing we can do is send copies of various documents that were prepared for previous hearings and other purposes. Many of these were not intended to be scientific reviews, so they may be of only limited use to you.

The following items are included:

1. "Petition for Review and Revision of Ambient Air Quality Standard for Photochemical Oxidants and Requirements for Control" submitted to Environmental Protection Agency by City of Houston July 11, 1977.

2. Letter of November 2, 1977 to Dr. J. H. B. Garner of EPA from Albert G. Randall, M.D., Director of Public Health, Subject: External Review Draft No. 1, Air Quality Criteria for Photochemical Oxidants and Oxidant Precursors.

3. Letter of November 22, 1977 to Dr. J. H. B. Garner of EPA from Herbert C. McKee, Ph.D., of the City of Houston Health Department, commenting on the subject of natural organic constituents and their action as oxidant precursors in response to questions raised by Dr. Basil Dimitriades of EPA.

4. Letter of January 27, 1978 to Mr. Joseph Padgett of EPA from Herbert C. McKee, Ph.D., City of Houston Health Department, enclosing the following:
    - A. Comments on proposed revision of Oxidant Standard presented by Herbert C. McKee, Ph.D., City of Houston Health Department, at Environmental Protection Agency public meeting, January 30, 1978.
    - B. R. K. Severs, Ph.D., "A Critique: A Method for Assessing the Health Risks Associated with Alternative Air Quality Standards for Photochemical Oxidants."
5. Letter of February 21, 1978 to Dr. J. H. B. Garner of EPA from Herbert C. McKee, Ph.D., City of Houston Health Department, Subject: External Review Draft No. 2, Air Quality Criteria for Ozone and Other Photochemical Oxidants.
6. Herbert C. McKee. "Testimony at Public Hearing Regarding Air Quality Standard Nonattainment Designations." Public Hearing, Texas House of Representatives, Select Committee on Offset Emissions Standards, Corpus Christi, Texas. April 26, 1978.
7. Herbert C. McKee. "Comments on Revision of Photochemical Oxidant Standard." Public Hearing, Environmental Protection Agency, Dallas, Texas. August 22, 1978
8. Herbert C. McKee. "Testimony at Public Hearing Regarding Auto Emission Control and Emission Offset Requirements." Public Hearing, Texas House of Representatives, Select Committee on Offset Emissions Standards, Houston, Texas. October 4, 1978.

There is a lot of duplication between these various documents, and I am sorry that we don't have time to edit them so that you could avoid reading so much repetitive material. Except for that, I think these documents summarize the problems we see in controlling photochemical oxidant, and the problems that present and future research should examine. I hope this information will be useful.

Best regards.

Very truly yours,

Herbert C. McKee ah

Herbert C. McKee, Ph.D.
Assistant Health Director
for Pollution Control

HCM/ah
Encls.

APPROVED:

James C. Watson, M.D., M.P.H.
Director of Public Health

Pier, Dr. Stanley M.,
Chairman
Gulf Coast Air Pollution Research Committee and
also Associate Professor of Environmental Health,
School of Public Health, University of Texas
Health Science Center at Houston

Statement of Dr. Stanley M. Pier, Associate Professor of Environmental Health, School of Public Health, The University of Texas Health Science Center at Houston and Chairman, Gulf Coast Air Pollution Research Committee.

I am most pleased to have the opportunity of appearing before you to present my views relative to the air pollution situation along the Texas Gulf Coast. You are aware of the fact that in response to the 1977 Clean Air Act Amendments, there was established the Gulf Coast Air Pollution Research Committee, of which I serve as Chairman, with the charge of providing the Environmental Protection Agency with "local inputs." All that I say here today has already been communicated to EPA in one form or another, but repetition will not be harmful.

The research program which brings Radian to Houston today is one concerning which my committee had involvement during the formative stages of the Request for Proposal. We urge EPA - successfully - to undertake the study as a needs assessment in the fullest sense of the phrase: a study of the nature, source and effects of the atmospheric stew known as Houston's air. We strongly urge that the effort be pursued with a fully open mind, without preconceived notions or constraints, so that the problem can indeed be defined, leading to productive research germane to the problem. Radian's work is especially important because it should constitute the basis and framework for further extensive and costly research which holds major implications for the health of our citizens as well as the economic development of the area we call home.

Several technical problems demand your consideration. High on the priority list is a clear definition of the chemistry and composition of Houston's air. An especially important matter relates to the mixture known as oxidants. We must define the nature and concentrations of oxidizing constituents other than ozone and oxides of nitrogen. This must be done to ascertain whether or not Houston has a problem similar to that studied in Los Angeles. A major corollary question is whether the Los Angeles control strategy is applicable to the Houston situation, an answer that can be given only on the basis of comprehensive analysis. You are certainly familiar with the fact that EPA has recently changed the standard from oxidant to ozone, an administrative determination that may not be appropriate to the facts of the situation. The fact is inescapable that although Houston achieves ozone/oxidant levels comparable to those experienced in Los Angeles, the effects are not comparable, suggesting at least a possibility that we are dealing with different problems.

The need for a comprehensive study of the chemistry of the Gulf Coast air pollution problem is emphasized by the dramatic discovery by the Texas Air Control Board research staff of a possible role for singlet oxygen in oxidant formation. If these results are borne out, it is not impossible that the entire control strategy will be shown to be seriously flawed.

A related question concerns the analytical measurement of ozone/oxidants. We have shown that measuring the Houston air by the method employed during the development of the oxidant standard and that presently utilized for enforcement at times gives results which are neither equivalent nor correlatable. These findings ought not be dismissed as "operator error." We need a confirmatory study to establish exactly what we are measuring, and how these measurements related to the health effects which have been postulated or observed.

Another concern relating to ozone/oxidants deals with the origin of these pollutants in our air and the contribution of uncontrollable natural background levels of precursor contaminants. There is disagreement as to how much contribution is made by the coniferous and other vegetation not very far from the Houston area. A comprehensive look should be taken at this question so that a final determination can be made as to precisely what improvement in air quality may be expected from the far-reaching, costly and potentially disruptive controls proposed.

The properties of Houston's air as they relate to the health of our citizens should be the paramount concern. Thus, the greatest attention should be paid to recommending the health studies most likely to provide answers relating to what controls are needed and what controls are unnecessary. These studies proposed to date by EPA are of limited scope and utility.

The study of chronic obstructive pulmonary disease patients reads suspiciously like the CHESS study. Independent researchers, the U.S. Congress Committee on Science and Technology and the General Accounting Office have levelled very serious criticism at the technical aspects of the CHESS study, and it is imperative that the mistakes of that very expensive and nonproductive program not be repeated. The question must also be posed as to whether the study of high school athletes will provide any useful information when one takes account of the differences between Houston and Los Angeles where the original study was conducted.

Inasmuch as the Radian study is charged to assess research needs in terms of both present and future air pollution problems, I would draw your attention to a potential problem that has not affected the Gulf Coast in the past to any significant degree. I refer to sulfur oxides pollution. Like the rest of the country, we will be called upon to increase our use of higher sulfur fuels for industrial and power generation purposes. This will add increments of sulfur oxides to our community air from a baseline that is essentially negligible. While the health effects of sulfur oxides have been studied extensively - though firm conclusions still elude us - the combination of sulfur oxides, heat and humidity, which will characterize the Gulf Coast situation, has not been investigated. This should be done before significant amounts of sulfur oxides are allowed to intrude into our air.

In your letter soliciting statements, you indicated that the identification of local resources which might be brought to bear on the problem was a key component of your study. I shall again mention the Gulf Coast Air Pollution Research Committee. This committee is composed of people who have much to contribute to studying and solving the problem. I wish to advise you, as we have advised EPA, that this committee is not being used to anything approaching the extent possible, and this will work to the detriment of the overall program. I urge you to assure that this valuable resource is employed.

In addition to the committee to which I have referred, I would draw your attention to the School of Public Health, where there is a tradition of research in air pollution dating back to the very beginning of the institution. We stand ready to assist beyond what we have already done in making facilities available to EPA and providing them with the results of our research, which we trust will receive a considered and respectful hearing.

In sum, I feel that the Radian study potentially has extreme importance. The value and utility of the study result will be determined primarily by how thoroughly and openly the task is approached and pursued. The study should stress investigation rather than advocacy, because only in such a spirit can a true "needs assessment" be accomplished.

Shelton, Nancy (for Dr. Joe W. Pyle, Director of
Physical Planning and Development)
Houston - Galveston Area Council

STATEMENT PRESENTED AT PUBLIC HEARING
OCTOBER 3-4, 1978
HOLIDAY INN MEDICAL CENTER

Conducted by

THE RADIAN CORPORATION
Austin, Texas

On behalf of the elected officials that constitute the leadership of the Houston-Galveston Area Council, I am pleased to make this statement today. I am Nancy Shelton, transportation planner for the H-GAC and I am making this statement for Dr. Joe W. Pyle, Director of Physical Planning and Development, who could not be here today.

The Houston-Galveston Area Council is the local planning agency and the council of governments charged with the responsibility of developing specific plans for the 13-county area around the Houston and Galveston population centers. This area, known as the Gulf Coast State Planning Region, has a population approaching three million people and approximately 12½ thousand square miles. The work program undertaken by the Area Council is under constant scrutiny by the local elected officials and significant outputs require their approval prior to official acceptance.

On May 19, 1978, the Texas Air Control Board approved a resolution designating the Houston-Galveston Area Council, functioning as the Metropolitan Planning Organization for multi-modal transportation planning in the Gulf Coast State Planning Region, to develop local responses to comply with the Clean Air Act

Amendments of 1977. Section 174 of this act specifically states that local organizations composed of elected officials should be involved in the planning process necessary to reduce the effects of pollution. Subsequent to the Texas Air Control Board resolution, Governor Briscoe officially designated the H-GAC to perform this service for the region in his letter of July 24, 1978, to the Administrator of EPA. The Area Council is now developing a work program consistent with Federal and State regulations that will assist the Texas Air Control Board in the preparation of revisions to the State Implementation Plan.

By agreement with the Texas Air Control Board, the H-GAC has two specific functions that will augment the TACB's effort in the preparation of the revisions to the State Implementation Plan that must be forwarded to the Environmental Protection Agency by January 1, 1979. These two areas are (1) Section 121 of the Federal Clean Air Act, Consultation, which addresses the information flow to the local governments of the region, and (2) Section 174, Planning Procedures, which specifies that local organizations of elected officials should be identified in those areas of non-attainment for carbon monoxide or photo chemical oxidants to participate in the process. The H-GAC agreement specifically identifies the responsibility for the evaluation of transportation control measures necessary to address mobile sources.

The success of the air quality problem is highly contingent upon excellent coordination and a sincere level of cooperation among those entities that are involved in the local area. It is to this end that I wish to make my official statement today. If the Radian Corporation, or anyone else, proposes to undertake a significant study of air pollution sources and consequences in the Houston area, it is essential that the highest level of coordination be undertaken with other organizations that have a mutual interest. Therefore, I request that the Houston-Galveston Area Council be advised, consulted and involved in all aspects of this study that have a direct bearing on the work program of the Area Council.

An example of mutual interest is the emissions inventory update in the work program proposed by Radian. A similar responsibility is the charge of the Area Council in response to the agreement with the Texas Air Control Board. It is only logical that any emissions inventory resident within the state offices, the local agencies, or to be developed in any research activity, be consistent and shared. All federal agencies support the commonality of data bases developed on public funding. It would be inconsistent with federal policy and, in fact, unconscionable to have separate efforts simultaneously underway in the Houston area without coordination.

Another area of mutual interest is the process of computer modelling and simulation to augment actual data. This area has not been fully developed locally; the mobile source aspect is an integral part of the overall problem and should involve the expertise of transportation planners that are currently involved in the planning process at H-GAC.

To summarize the position of the Area Council, it will be in the best interest of the citizens and the local governments in the Houston-Galveston area, if local resources are utilized to the fullest extent. Therefore, the expertise and involvement of the Area Council will improve the acceptability of the research undertaken by the Environmental Protection Agency. Only with the participation of the local elected officials can the results be useful and disseminated optimally. We look forward to cooperating in every way possible with the Environmental Protection Agency to the successful conclusion of the research project.

Smith, Francis V.

302 Southchester Lane
Houston, Texas, 77079
October 6, 1978

Mr. Gary Tannahill
Radian Corporation
8500 Shoal Creek Blvd.
Austin, Tx., 78766

Dear Mr. Tannahill:

Having been an attendee at your October 3rd program at the Holiday Inn in Houston, I have a few comments and questions which came to mind after the presentations and discussions. Although I am a member or officer of several different environmental groups, I am writing solely as a private citizen, and not as a spokeman for any of them.

I am concerned that not enough emphasis was placed on long term chronic effects studies. I realize that these are difficult, expensive and time consuming. But they have been done in other parts of the country, and if such a long term study were to be done here, it might help explain the higher than average mortality rates in Houston for some types of cancer, and respiratory diseases. While current funding does not permit such a long term study, a statement that such a study should be done with proper funding, could be included in your research plan. Do I presume correctly that the two health effects studies (mentioned in the EPA newsletter) are two of several more to be contracted for in the future?

As sulfur oxides may well become a problem on the Gulf Coast with fuel conversion, SO_2 and sulfate studies seem to be contemplated. Are you also going to include consideration of sulfites, which also seem to be a health hazard?

In general I concur in the opinion that the air over greater Houston should be characterized and studied, with the emphasis being placed on the possible health effects on the persons breathing it.

I hope you will have further meetings such as this one as your work progresses, because further updates and discussions could be very helpful and informative - hopefully for you as well as for those of us who live in the area.

Sincerely,

Frances V. Smith

Frances V. Smith

RECEIVED
OCT 16 1978

Spaw, Steve, P. E., Deputy Director
Stewart, Bill, P. E., Executive Director
Texas Air Control Board

TEXAS AIR CONTROL BOARD

8520 SHOAL CREEK BOULEVARD
AUSTIN, TEXAS 78758
512/451-5711

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JEROME W. SORENSON, P. E.

October 2, 1978

Radian Corporation
8500 Shoal Creek Boulevard
Austin, Texas 78756

Attention: Mr. Gary K. Tannahill

Dear Mr. Tannahill:

Enclosed are our comments for your consideration in developing a plan for an air pollution study program in the Texas Gulf Coast area.

We appreciate the opportunity to offer these comments. If we can be of further assistance, please let me know.

Sincerely,

Bill Stewart, P.E.
Executive Director

Enclosure

STATEMENT BY

STEVE SPAW, P.E., DEPUTY DIRECTOR
TEXAS AIR CONTROL BOARD

AT

PUBLIC MEETING
TO RECEIVE COMMENTS ON THE OBJECTIVES
OF A PLAN FOR AN EPA AIR POLLUTION STUDY PROGRAM
IN THE TEXAS GULF COAST AREA

ON

OCTOBER 3, 1978

IN

HOUSTON, TEXAS

As a control agency, the Texas Air Control Board (TACB) needs to know what bad effects air pollution is having and what further emission controls are needed to prevent those effects. Obtaining this information requires a thorough knowledge of the relationships between local emissions and resulting air contaminants and between the contaminants and effects. Since we are a control and not a research agency, we are largely dependent on the efforts of others to produce that information.

For this reason, we are especially pleased that the Texas Gulf Coast air pollution research project is underway. The efforts of our Texas Congressmen whose work led to the authorization and funding of this project deserve special mention. We have high hopes for this effort and strongly recommend that this type of air pollution research effort continue in the future beyond the three year period for which you are preparing the research plan.

EPA deserves praise for beginning the Texas Gulf Coast air pollution research program with a needs assessment project and development of a comprehensive research plan. One of the requirements for this needs assessment project you are working on is so important that it deserves specific mention. It is the requirement to analyze each proposed part of the research effort thoroughly to determine whether it is workable and likely to produce definitive results. Each part of the plan must fit together with the other projects in the plan to produce the most useful information possible. We are pleased that these specifications have been written into the contract for preparing the research needs assessment and plan.

WE AGREE WITH THE INDICATION IN SECTION E OF THE "SCOPE OF WORK" THAT THE MOST IMPORTANT FOCUS OF THIS STUDY OF AIR POLLUTION IN THE TEXAS GULF COAST AREA SHOULD BE HUMAN HEALTH EFFECTS. WE ARE ALL AWARE THAT THE AIR IN THIS AREA SOMETIMES STINKS AND IS HAZY. HOWEVER, WE DO NOT YET KNOW WHETHER THE POLLUTION WE CAN OBSERVE WITH OUR SENSES CAUSES ANY SIGNIFICANT HEALTH EFFECTS. WE ARE NO MORE CERTAIN ABOUT THE HEALTH EFFECTS OF OZONE OR OF THE ORGANIC CHEMICALS THAT WE CAN DETECT ONLY WITH INSTRUMENTS.

WE ARE, THEREFORE, CONCERNED THAT THE HEALTH EFFECTS STUDIED BE MORE COMPREHENSIVELY DEFINED THAN IN MOST PAST EFFORTS TO RELATE HEALTH EFFECTS TO AIR POLLUTION. THE RANGE OF HEALTH EFFECTS CONSIDERED SHOULD INCLUDE CHRONIC EFFECTS SUCH AS EMPHYSEMA. WE NEED TO KNOW WHETHER CONTAMINANTS IN OUR AIR CONTRIBUTE TO THE RISKS OF MUTATION AND OF CANCER. ADDITIONALLY, IT IS NOT ENOUGH TO KNOW WHETHER AIR POLLUTION IN THIS AREA AGGRAVATES SYMPTOMS IN PATIENTS ALREADY SUFFERING FROM CHRONIC RESPIRATORY DISEASE; WE NEED ALSO TO KNOW WHETHER THIS AIR POLLUTION CAUSES OR ACCELERATES THE DEVELOPMENT OF SUCH HEALTH PROBLEMS. IF THE CAREFUL SCREENING OF THE RESEARCH TOOLS AVAILABLE INDICATES THAT THEY ARE INADEQUATE TO LOOK AT THE RELATION OF EACH OF THESE EFFECTS TO AIR POLLUTION, THAT FACT SHOULD BE DOCUMENTED IN THE STUDY PLAN YOU ARE PREPARING. IT IS OUR HOPE THAT THE TEXAS GULF COAST STUDY PLAN WILL COMPLIMENT PAST AND PRESENT EFFORTS OF THE TEXAS AIR CONTROL BOARD AND OF OTHERS.

WE ARE CONTINUING AND REFINING OUR REVIEW OF TOXIC AND SUSPECT COMPOUNDS THAT ARE EMITTED BY INDUSTRIAL FACILITIES IN TEXAS. A PART OF THIS WORK INVOLVES REFINING OUR EMISSIONS INVENTORY SO THAT IT WILL PROVIDE THE INPUT

FOR MATHEMATICAL MODELING OF EMISSIONS. THIS CAPABILITY WILL BE USED TO CALCULATE PUBLIC EXPOSURE TO EACH COMPOUND UNDER REVIEW. MONITORING FOR SPECIFIC COMPOUNDS AND EMISSIONS INVENTORY EFFORTS AS PART OF THE TEXAS GULF COAST PROJECT COULD SUPPLEMENT AND VERIFY THE RESULTS OF OUR INVENTORY AND MATHEMATICAL MODELING PROJECT. OUR EMISSIONS DATA, AS WELL AS AIR QUALITY AND PERMITS DATA, ARE, OF COURSE, AVAILABLE FOR YOUR USE.

I HAVE PROVIDED YOU WITH COPIES OF A REPORT ENTITLED "TEXAS RESEARCH NEEDS IN AIR POLLUTION CONTROL". THIS REPORT WAS PUBLISHED IN 1977 AND LISTS OVER 150 RESEARCH PROJECTS WE RECOMMENDED FOR TEXAS. WHILE THE SCOPE OF OUR RESEARCH NEEDS LIST WAS SOMEWHAT BROADER THAN THE PROJECT YOU ARE NOW WORKING ON, MANY OF THE SUGGESTIONS DISCUSSED IN THE LIST ARE RELEVANT TO THIS PROJECT AND SHOULD BE CONSIDERED. HOWEVER, THEY SHOULD BE SUBJECTED TO THE SAME CRITICAL REVIEW AS ALL OTHER PROPOSALS CONSIDERED IN THE NEEDS ASSESSMENT PROJECT YOU ARE BEGINNING.

IN CONCLUSION, I WANT TO REITERATE OUR PLEASURE IN SEEING THIS PROJECT FINALLY TAKING PLACE. IT REPRESENTS THE CULMINATION OF LONG AND ARDUOUS EFFORTS BY MANY PEOPLE WHO RECOGNIZE THE PROBLEMS OF THIS AREA AS BEING SOMEWHAT UNIQUE AND DESERVING OF SPECIAL STUDY. IT IS OUR SINCERE HOPE THAT EXPERIMENTS CAN BE DEVISED TO ANSWER MANY OLD AND PERPLEXING PROBLEMS, AS WELL AS ADDRESSING NEW AREAS OF CONCERN. AGAIN, I CAN ASSURE YOU OF THE ASSISTANCE AND COOPERATION OF THE AIR CONTROL BOARD IN PROVIDING WHATEVER INFORMATION AND DATA WE HAVE THAT MAY BE HELPFUL IN DEVELOPING THE STUDY PLAN YOU ARE PREPARING.

THANK YOU FOR THE OPPORTUNITY TO PARTICIPATE IN THIS MEETING. IF THERE ARE ANY QUESTIONS, I WILL BE GLAD TO TRY TO ANSWER THEM.

Tarr, Jim
Toxcon Engineering Company, Houston

THE REASONS WHY HOUSTON'S AIR ISN'T CLEAN

A Report for the Environmental Protection
Agency and the Texas Air Control Board

October 1, 1978

TOXCON ENGINEERING COMPANY
Houston, Texas

THE REASONS WHY HOUSTON'S AIR ISN'T CLEAN

The discussion which follows is an effort to clarify the air pollution abatement process. In Texas, air pollution abatement is achieved by developing, implementing, and enforcing regulations which limit atmospheric emissions. It follows then that this paper is primarily a discussion of the way in which air pollution regulations are developed. The responsibilities of the state and federal governments in this process will be indicated. Constraints which inhibit the development of technically sound air pollution regulations will be identified. Some simple suggestions about how the process might be improved will be listed.

The thesis of what is written here is simple. Houston's air pollution problems haven't been solved because the basic, fundamental tools required to understand them properly haven't been developed. In short, that which is emitted into the atmosphere is largely undefined. How it acts when it gets there is also not understood.

As mandated by Sections 109 and 110 of the federal Clean Air Act, the development of air pollution regulations is a two step process. The first step, a federal responsibility, requires the establishment of primary ambient air quality standards for so-called criteria pollutants.* Intended to protect public health with "an adequate margin of safety", the primary ambient air quality standards define a maximum acceptable concentration of pollutants in the air that the public breathes. Primary ambient air quality standards have been established for carbon monoxide, hydrocarbons, oxides of nitrogen, particulate matter, photochemical oxidants, and sulfur dioxide.

The second step involves the development of implementation plans by state governments. An implementation plan is simply a description of the specific means to be utilized by a state to reduce air emissions from sources such that ambient air concentrations are maintained within the limits set by the primary standards. Stated another way, the Environmental Protection Agency (EPA) defines acceptable ambient air concentrations, and the Texas Air Control Board (TACB) limits emissions from fixed and mobile sources to achieve those concentrations.

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*Secondary ambient air quality standards, requisite to protect public welfare, have also been mandated for the criteria pollutants. In the interests of brevity, the secondary standards will not be discussed.

At first glance, the problem of designing a regulation to limit emissons into the atmosphere to achieve a well defined concentration appears elementary. Consider the simplest case of a single stack emitting particulate matter into the atmosphere. Imagine a box of known dimensions situated in such a way that all particulate matter which leaves the stack is captured in the box. Now, utilizing a simple mathematical procedure, the concentration of particular matter in the box can be calculated at any time if the flowrate of particulate matter from the stack is known. Furthermore, by adjusting the flow of particulate matter from the stack, the concentration in the box can be maintained at any desired value.

In actual practice, the process of developing an air pollution regulation is quite complex. Consider the problem of limiting emissions into the atmosphere such that the primary ambient air quality standard for photochemical oxidants is achieved. Thinking in terms of the one stack-one box example, the regulation development process involves relating stack emissions (pounds per hour) to atmospheric concentration (parts per million) through an appropriate mathematical manipulation (or model). Given an acceptable concentration of photochemical oxidants, the difficulties can be grouped into three categories of constraints. Those categories are natural constraints, mathematical constraints, and socio-economic constraints.

Natural constraints that inhibit the development of effective regulations include the effect of weather, the effect of atmospheric interactions, and the difficulty of "dimensioning the box". Weather has a tremendous effect on the concentration of pollutants in the atmosphere. As wind speed and atmospheric turbulence increase, the concentration of pollution downwind of the source of air emissions will decrease. A change in wind direction will radically change the concentration of pollution seen by an observer if the new wind blows from source to observer instead of from observer to source. Predicting the precise effect of weather changes on the ambient air concentration of pollutants is an art, not a science.

Another natural constraint includes the effect of atmospheric interactions. Photochemical oxidants are a family of chemical compounds that result from a series of complex reactions that occur in the atmosphere. The necessary constituents for the formation of photochemical oxidants are hydrocarbons, oxides of nitrogen, and sunlight. The exact way in which these three constituents interact to form photochemical oxidants is not known. Furthermore, depending upon which particular hydrocarbons are involved in the reaction mixture, reaction pathways and products may vary considerably.

As photochemical oxidants can be added to the atmosphere by chemical reaction, they may also be removed by processes of absorption and adsorption. Water soluble photochemical oxidants can be absorbed into solution when contacted by small water droplets that exist in the atmosphere in the form of fog or clouds or both. Other photochemical oxidants may be physically attached (or adsorbed) on the surface of particulate matter present in the atmosphere from a variety of sources. The net result is that photochemical oxidants appear and disappear in the atmosphere in ways little understood and at rates that are generally unknown.

The difficulty of "dimensioning the box" is also considerable. To control the concentration of any material in the atmsophere, it is necessary to define a three dimensional space of known dimensions. As no portion of the atmosphere can be realistically considered a closed space, the choice of appropriate dimensions becomes difficult. Should a "box" cover the limits of a city, a county, several counties, or even a state? Once an area is chosen, should the depth be hundreds of feet, thousands of feet, or miles? These questions have not been appropriately answered to date.

Another group of difficulties are the mathematical constraints. The mathematical constraint most easily dealt with involves a compilation of atmospheric emissions known as an emission inventory. Considering the photochemical oxidant problem again, the emissions that must be compiled include hydrocarbons and oxides of nitrogen. The existing emission inventories for both of these pollutants are inadequate, but the following observations will focus only upon hydrocarbons.

The emission inventory for hydrocarbons is both incomplete and inaccurate. For the most part, only hydrocarbon emissions from discrete point sources in industrial facilities are compiled. Hydrocarbon emissions from sources other than stacks are generally not compiled. The vast majority of so-called fugitive emissions from industrial facilities are disregarded. Likewise, hydrocarbon emissions from mobile sources such as cars, buses, trucks, and ships are not routinely inventoried. With regard to accuracy, most existing information related to hydrocarbon emissions from point sources is based on estimates instead of actual measurements. The estimates that are made vary from crude to sound and sophisticated. Taken as a whole, the existing emission inventory for hydrocarbons is suspect. It also happens to be nearly three years old. An accurate emission inventory for hydrocarbons emitted into the atmosphere over Houston has never been compiled.

The mathematical model used to relate emissions and atmospheric concentrations is another problem. With regard to photochemical oxidants, an appropriate model must somehow relate the emissions of hydrocarbons and oxides of nitrogen from tens of thousands of sources to an atmospheric concentration of a group of reaction products that arise by an undefined mechanism while accurately accounting for space, time, and weather. That task is clearly beyond existing capability. Lacking an appropriate model, an approximation has been substituted. The model most recently employed is called the proportional rollback model. This model simplistically assumes that if hydrocarbon emissions are reduced fifty percent, then photochemical oxidant concentrations in the atmosphere will be reduced fifty percent. A twenty-five percent emission reduction will cause a twenty-five percent reduction in atmospheric concentration, etc. Events in the Houston area have clearly shown that the proportional rollback model is not appropriate.

In light of the failure of the proportional rollback model to adequately relate hydrocarbon emissions and atmospheric ozone concentrations, it has been abandoned. Implementation plan development will now be based on a "kinetic" model. This new modeling approach can accurately be described as a modest revision of the proportional rollback model. It is a simplistic, empirical attempt to describe a complex, inadequately understood phenomena. In all probability, it will also fail.

Confounding the mathematical constraints mentioned above are two other factors which deserve mention. One of these factors involves the routine monitoring of ambient air quality. The other factor concerns attempts to conceptually compare estimated emission rates with measured ambient air quality.

As explained above, the EPA has developed a primary ambient air quality standard for photochemical oxidants. Ozone is one of the photochemical oxidants. There are an unknown number of other photochemical oxidants formed in the atmosphere. In this area, ozone is the only photochemical oxidant that is routinely monitored. In effect, the presence of all other photochemical oxidants is ignored.

A second cause of confusion involves attempts to relate reported emission reductions to ambient air quality. The claim is often made that local hydrocarbon emissions have been reduced dramatically without a corresponding decrease in the measured ambient air concentration of ozone. Statements to this effect represent a classic example of attempting to equate apples and oranges. Inventories of hydrocarbon emissions from industrial facilities have been compiled. These numbers are normally estimates, not measured values. Typically, they are derived by the use of emission factors originally developed in California oil refineries some twenty years ago. Furthermore, The emission estimates are routinely reported in units of tons per year. Conversely, the ambient air concentration of ozone is measured at a number of sites in and around Houston every five minutes. Twenty four times a day, twelve consecutive measurements are combined to yield an hourly average ozone concentration. In a given year then, each ozone monitoring site will report approximately 8500 separate hourly averages. Attempting to compare an annual average hydrocarbon emission rate with a single hourly average ozone concentration is statistical and mathematical nonsense.

The last set of constraints can be labeled socio-economic. Examples of this kind of constraint can be observed among both those who are regulated and those who regulate. Owners and operators of most sources of air emissions will not readily accede to make the commitment necessary to reduce those emissions. The most popular example is the automobile. It has been suggested that one effective way of reducing air emissions from automobiles is to limit vehicle miles traveled through gasoline rationing and other means. That suggestion was greeted with a resounding no thank you by the general public. Industrial operators are also somewhat reluctant to reduce air emissions, particularly when the costs involved are high. In certain situations plant operators may obtain exemptions that allow significant quantities of hydrocarbon emissions from point sources. This is exemplified by Rule 505.232 of the TACB which allows unabated hydrocarbon emissions of as much as 250 pounds per hour per stack under certain circumstances.

Another important socio-economic constraint concerns the existing relationship between the TACB and the EPA. Over the years the association between these two government entities has deteriorated. Too often, the two groups are rivals pitted against each other in an unseemly struggle for position and prestige. The common goal of protection of the public health is obscured in personality conflict, bureaucratic ineptitude, and plain hard headedness. This lack of cooperation is best illustrated by the inability of the two agencies to agree upon a rational plan to control hydrocarbon emissions. With regard to this problem, lawsuits and recrimination have often been substituted for cooperation and dialogue.

Clearly then, there are a number of identifiable reasons why Houston's air isn't clean. These reasons can be grouped into three categories. The quest for clean air is frustrated by natural constraints, mathematical constraints, and socio-economic constraints.

If Houston's air pollution problems are to be solved, then at least three critical steps must be taken. An accurate, up-to-date emission inventory must be developed. A mathematic model that can realistically relate atmospheric emissions and ambient air quality must be designed. Most importantly, the government agencies responsible for overseeing air pollution control efforts must forget their differences and work together for the common good.

Jim TARR

ADDITIONAL REFERENCE SUBMITTED

TEXAS RESEARCH NEEDS IN AIR POLLUTION CONTROL, Texas Air Control Board, Austin, TX, April 1977.

Walker, Harry M., Ph.D.
Monsanto Chemical Intermediates Co.

Monsanto

MONSANTO CHEMICAL INTERMEDIATES CO.
P. O. Box 711
Alvin, Texas 77511
Phone: (713) 581-2161

October 12, 1978

Mr. G. K. Tannahill
Radian Corporation
8500 Shoal Creek Blvd.
Austin, Texas 78758

Subject: Technical Recommendations for the HAPS Program

Dear Gary:

I am sending you my suggestions by letter rather than presenting them at your October 3rd meeting for two reasons. First, I did not have them in writing at that time. Second, as usual these days the presentations made, as long as I stayed at the meeting, tended to be more political than technical.

I am limiting my suggestions to just three, all in the ozone/oxidants area; one regarding health effects and the others regarding atmospheric chemistry. A discussion of each follows.

I. HEALTH EFFECTS — Personal Oxidant Monitors

I am convinced that epidermiological studies concerning the health effects of ambient ozone on oxidants are going to continue to be inconclusive until a method of accurately quantizing the exposure of each individual subject is available. Personal monitoring devices are the answer as outlined in the attached letter to Dr. Chapman. The technology to use personal pumps now exists. Badges which are oxidant sensitive can probably be developed rather readily. (See the letter for details.)

I don't believe that any more epidermiological studies for ozone or oxidant effects should be attempted until these techniques are established. Once they are, a number of old studies should be repeated and many new ones can be devised with assurance that they are then more likely to yield definite results.

I am in correspondence with Dr. Chapman on this matter and am sending him additional information which he requested. Radian's support would help to bring the program about.

RECEIVED
OCT 16 1978

II. ATMOSPHERIC CHEMISTRY

A. NO_x vs. NMHC - Aerometric

Despite all that has been done by many groups including HAOS, there is no clear real-world evidence as to which pollutant, NO_x or hydrocarbons, controls photochemical ozone formation in a city such as Houston.

Much effort has been made to establish such evidence by data analysis of routine aerometric measurements taken at agency sites. In general, this work has been inconclusive although general studies suggest that NO_x emissions control. This was the result of the study done by Dr. Worley of the University of Houston for HAOS.

The problem is, to a considerable degree, analytical. In the past, NMHC and NO_x analyzers have shown both poor reliability and poor accuracy, particularly at the low end of the scale, which is critical to such a study.

Probably the Beckman 9800-type NMHC analyzer is inadequate for the task and future effects will have to be based on GC analysis for hydrocarbons. Older NO_x analyzers are probably similarly unequal to the task. However, new units can now get down to 2 pbb and should do the job.

One problem with aerometric data taken at fixed sites is that the upwind HC/NO_x pollutant ratio is going to be relatively invariant for each site. True, this ratio will shift with wind direction but in Houston, at least, episodic levels of ozone generally are characterized by winds from a narrow arc centered on ENE.

Without the leverage of major shifts in HC/NO_x ratio, the problem of defining the controlling pollutant is not going to be elucidated from the analysis of aeromatic data.

The more I think about the problem the more I am convinced that measuring pollutant concentrations before the reaction takes place than correlating these data with ozone concentrations taken 5 to 8 hours later is not going to work. Six to nine a.m. pollutant concentrations vary widely but do not represent real variations in pollutant emission rates which are essentially invariant. Variations in the 6-9 a.m. concentrations depend almost entirely on the micrometeorology of the site subject only in a limited way to the general meteorology of the time and area.

Thus, 6-9 a.m. pollutant concentrations observed with zero wind and an inversion at 200' will be much higher than those observed at 2 mph and 1000'. However, the ultimate dilution 6 hours and 25 miles downwind with identical 4000' mixing heights could easily be the same.

The present EPA program going on in Houston seeks to avoid this problem by monitoring precursors intensively in a "window" using both surface

A. NO_x vs. NMHC - Aerometric (Continued)

and aerial monitors. If the actual flow through the window can be defined for an adequate period, then correlations with downwind ozone maxima could work. However, I feel that major uncertainties are still going to remain because of inability to sample in the critical ozone between the surface and perhaps 500', and because of major abrupt horizontal variations in source strength across the window area.

It, therefore, appears to me that the best way to really get at pollutant concentration is to measure then after the reaction. True, this is also after dilution which makes it much harder and after much has reacted away. However, if the instruments are sufficiently sensitive the dilution problem can be handled.

Reaction is more complex. Using GC hydrocarbons analysis, we can track the unreactives such as the paraffins making the assumptions that only a limited and relatively constant amount has reacted. Thus, final HC will be a direct function of initial HC and correlation should be preserved. Since the amount destroyed will actually be a function of the degree of photochemical reaction going on, a more sophisticated assumption might be this:

$$HC_{\text{initial}} = HC_{\text{final}} (1. + f(O_3 \text{ max}))$$

NO_x concentrations presents more of a problem because of its greater reactivity. However, something like:

$$NO_{x\ \text{initial}} = NO_{x\ \text{final}} (1. + f(O_3 \text{ max}))$$

seems appropriate. If PAN data are taken, PAN could be added in.

Consideration of a number of factors suggests that this isn't going to work if the reaction path is across a region with many sources. Therefore, the correlation attempts should be confined to downwind points in the plume areas outside the dominant source areas.

All this complicated discussion leads to a pretty simple recommended experiment.

Field Experimental Program:

Using a mobile monitoring van equipped for ozone, NO_x and hydrocarbons via GC; sample in 4-6 hours downwind plume areas at maximum ozone time. In practice, monitor from 12:00 p.m. to 4:00 p.m. each day at chosen downwind points meeting the criteria discussed. The monitoring points should be based upon 10 meter surface winds between 6 and 12 a.m. in the general area.

The only data used would be daily O_3 maximum, the HC scan and the NO_x data for the same hour. Data correlation treatment should be as discussed.

A. NO_x vs. NMHC - Aerometric (Continued)

It is most probable that correlation will be more successful under non-episodic conditions as the initiation factors which control episodes may be so dominant as to completely override pollutant concentrations. Therefore, the correlations should be tried for non-episode days alone, for episode days alone, and for all days. A variety of cut points can be tested to separate episode and non-episode days.

I would anticipate that the analysis might result in a good correlation between NO_x and O_3 maximum for non-episode days; no correlation for HC on any basis, and no correlation for NO_x on episode days. If good correlations should be obtained for hydrocarbons or for episode days,of course, it would provide major support for the EPA position that only concentration counts and that hydrocarbons control.

In support of this line of reasoning, I am attaching a recent paper by Graedel which seems to present the best overall picture of the current photochemical process that I have seen. Note that the entire paper deals with non-episodic levels. Even Graedel excepts episodes though perhaps not for the same reasons that I except them.

Another experimental program stemming from this line of logic would be to mount a program for the field measurement of hydroxyl ion concentration. This would be particularly pertinent if done in rural areas. If it can be shown that rural hydroxyl increases after fronts, before episodes or during episodes, it would be an important insight and would help complete the picture spanning the gap between stratospheric injection, fronts, ^{7}Be and photochemical episodes.

Unfortunately, I am not sure of the state of the art of this measurement. It may be too complex for a real field study. I hope you can look into this.

B. NO_x vs. NMHC - Experimental

Another approach to the question would be the Captive Air Program considered by HAOS. I feel that our concept of collecting real-world air samples and running the experiment in two bags with one bag as a control and one with conditions perturbed is basically sound. Certainly it can answer questions concerning the effects of initial reactant concentration. Initiation effect probably cannot be evaluated because the bags are going to become free-radical contaminated like all smog-chambers.

You are familiar with the HAOS thinking on this program. I suggest that this program be a part of Radian's recommendations to EPA for inclusion in HAPS.

Sincerely,

Harry M. Walker

Harry M. Walker, Ph.D.

HMW:fm
Attachments

cc: Dr. Basil Dimitrides
U.S. Environmental Protection Agency
Environmental Research Laboratories MD-59
Research Triangle Park, N.C. 27711

Monsanto

MONSANTO CHEMICAL INTERMEDIATES CO.
P. O. Box 711
Alvin, Texas 77511
Phone: (713) 581-2161

September 1, 1978

Dr. Robert Chapman
United States Environmental Protection Agency
Health Effect Research Laboratories
Environmental Research Laboratories
Research Triangle Park, NC 27711

Dear Dr. Chapman:

I attended the EPA meeting in Houston on July 26 which was for the purpose of reviewing and discussing the EPA proposals for research to be included in the pending Houston Air Pollution Study (HAPS).

I came prepared to offer constructive suggestions on details of the research. However, when the political types, who had no interest whatsoever in research, were permitted to intrude into and largely take over the meeting it was obvious that there was no point in presenting my thoughts at that time.

With respect to ozone health effects, I believe that the most seriously neglected facet is the question of actual human exposures vs. the official monitored levels. Limited existing data suggests that most people, in their daily activities, will be exposed to less (probably much less) than one-half of the officially measured value reported for any areas. This is so because of the rapid destruction of ozone on surfaces. This rapidly reduces its concentration in enclosed areas; areas under trees, between buildings, etc. This phenomenon does represent an important natural protection factor which merits consideration in the standard setting process.

This factor was referred to by several speakers at the recent Dallas hearing on the ozone standard (August 22). I am attaching a copy of my remarks which developed the subject rather fully. I am also attaching a copy of my follow-up letter providing supplementary information and additional references.

Despite the studies cited which strongly support the assertion that no one is exposed to ozone at the monitored concentrations, I believe that additional quantative data is needed.

The most direct way to measure actual exposure will be with personal monitoring devices which can be worn by the subjects.

At the moment, the only credible way to do this would be with battery-operated personal pumps. These would sample ambient air taken via a Teflon tube beginning near the subject's breathing zone and deliver this air to a sampling solution. The pumps are now widely used in industrial hygiene-type exposure studies. They sell for about $100 each and have entirely adequate sample flows. The flowing sample would pass through midget impingers containing NBKI reagent. With this technique a meaningful, though limited, program could be mounted soon and would be worth doing.

The real potential of the program, however, will depend upon the development of exposure badges. A great deal has been accomplished in developing such badges in recent years and it is my opinion that units specific for photochemical oxidants can readily be developed using a variation of the KI technique.

I would attempt to incorporate a buffered KI reagent in a starch-containing gel protected by a very thin film of silicone rubber. The badges would later be read by transmission photometry at the proper wavelength for the starch-I_3 complex. If the silicone film limits sensitivity too much, I would test microporous Teflon as an alternate.

For the purposes of this type of research, I do not believe that the differences between ozone and oxidants are significant.

With simple monitoring badges, people can be exposure-tested by the hundreds. Various intervals of time can be used probably from 3 hours up to several days. Naturally, numerous calibration and validation procedures would have to be incorporated including exposure of badges right at the local agency-monitoring manifolds.

With a large study it will become possible to classify percentage exposures by population groups — housewives, office workers, construction workers, taxi drivers, etc. Ultimately, the badges could be used in conjunction with a real epidermiological study where the ozone control would be from the badge measurements rather than from the local monitor. Without a doubt, a major problem with many past epidermiological studies has been the fact that actual individual exposures were not properly reflected by the agency monitors referenced.

Accordingly, it is recommended:

(1) That EPA include a limited program of personal pump monitoring in its immediate program (perhaps 25 individuals, 4 hours/day, for 30 days).

(2) That EPA award contracts for the development of a KI-based photochemical oxidant personal exposure badge.

(3) That EPA plan an extensive badge study in the 1979 and 1980 segments of the HAPS program.

Sincerely,

Harry M. Walker

Harry M. Walker, Ph.D.
Air Control Coordinator

HMW:fm
Attachments

APPENDIX A

CONGRESSIONAL HEARINGS

SPECIAL URBAN AIR POLLUTION PROBLEMS: DENVER AND HOUSTON

SPECIAL URBAN AIR POLLUTION PROBLEMS: DENVER AND HOUSTON

HEARINGS

BEFORE THE

SUBCOMMITTEE ON THE
ENVIRONMENT AND THE ATMOSPHERE

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

NINETY-FIFTH CONGRESS

FIRST SESSION

NOVEMBER 19, 21, 1977

[No. 52]

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LETTER OF TRANSMITTAL

Hon. Olin E. Teague,
Chairman, Committee on Science and Technology,
U.S. House of Representatives

Dear Mr. Chairman: I am transmitting herewith the record of two days of hearings that the Subcommittee on the Environment and the Atmosphere held in Houston and Denver to investigate the particular air pollution problems of those cities. I also want to discuss in this letter some of the findings of our hearings.

First, the two cities displayed many similarities and differences. For example, Denver now appears to be in many ways at a stage of development which Houston passed through several years ago. And each city seems to have a rather unusual air pollution situation. In the case of Denver, it is the large number of automobiles which are operated at the high altitudes of Denver and therefore emit more pollutants than they would at sea level. In the case of Houston, there is the unusual concentration of petrochemical plants, resulting in high levels of hydrocarbon emissions. Thus, the two cities seem to be on similar developmental courses (but Houston is a little bit ahead) and each seems to have its own unique air pollution problem.

The several witnesses that testified in Denver seemed to be saying that they are quite aware that Denver has an air pollution problem; in fact, it even has a name, the "Brown Cloud" (for which I take no credit), and yet they do not know how to attack this problem. There seems to be belief that automobile emissions are largely responsible for the pollution, and there have been some attempts to reduce vehicle miles traveled, for example, through increased use of buses, but this has had very little impact on the problem. In fact, the increase in bus ridership has made less than a 1 percent impact on total vehicle miles traveled. Dr. C. S. Kiang made the very good point that there is a need for a long-term research program to develop a sound and fundamental understanding of Denver's problem in order to avoid attempting a "quick fiix" solution that in the long run only causes more problems. In last year's EPA research authorization bill, our committee report recommended that EPA conduct a study of Denver's air pollution problems, but it does not appear that they are undertaking such work on their own. On the other hand, the Motor Vehicle Manufacturers' Association has begun a $700,000 study in this area and EPA intends to cooperate with them. I intend to urge EPA to make this an active cooperation, and indeed, to devote some resources of their own to a parallel and related study.

In Houston, the witnesses agreed that several expensive control measures have been adopted which appear to have reduced hydrocarbon emissions by 40 percent. Despite this apparent reduction in emissions, there have been no changes in the oxidant concentrations and

Houston does not meet the national ambient air quality standard. The witnesses almost unanimously questioned whether or not further hydrocarbon reduction (which is what is required in the EPA-mandated State implementation plan to enable Houston to reach the oxidant standard) will indeed result in reduction in oxidant concentrations. The question that arises—which no one was able to answer—is whether or not there really has been a 40 percent reduction of hydrocarbon emissions. Apparently this 40 percent is calculated from emission inventory data, which is not always reliable. Nevertheless, it seems to be true, based on testimony of the EPA witness, that EPA cannot promise that further reduction of hydrocarbons will lead to a proportionate reduction in oxidant concentrations. That is, it appears that the agency policy is that hydrocarbon reduction will result in reduction of oxidant concentrations, but the physical mechanism for explaining exactly how this will occur was not described. This was brought out in a dialogue between Mr. Eloy R. Lozano, EPA Region VI, and Congressman Bob Eckhardt, of Houston, who accepted my invitation to attend the hearings because of their importance to his district.

It thus appears that in both the Houston and Denver cases a solid, fundamental, understanding of the photochemistry of air pollution would help a great deal in alleviating the tremendous uncertainty as to the causes and cures of the respective problems. In fact, Dr. Herbert McKee of the city of Houston's health department testified that if research could confirm certain tentative conclusions about the relationship between emissions and concentrations of oxidants, "the importance of such a conclusion in devising future control strategies is almost beyond calculation." I think that this testimony as to the value of good research is very true and it would apply to Denver, which is now grappling with the question of what to do about its problems, as well as to Houston, which is trying to understand the apparent lack of effectiveness of measures already undertaken.

On the other hand, Mary Rollins of the Citizens' Clean Air Coalition in Houston pointed out that, "For sure, there shouldn't be a moratorium on regulations while we await the results from the needed research." This epitomizes the problem facing EPA; they have to act because they know there are problems and yet they have to act on the basis of incomplete information.

In my view, what is needed is a coordinated program of control and research. The air-regulatory office under Assistant Administrator Hawkins must cooperate with Steve Gage's Office of Research and Development in planning, supporting and executing a long-range program of research to develop the information needed to understand urban air pollution problems.

A part of this research program must be communication with the regulatory offices so that as new information is obtained it can be fed as appropriate into the regulatory process.This is not the way EPA research is often conducted now. At present, it appears that EPA research programs are typically conducted as a series of short-term projects, each generating an incremental bit of information. That is, there appears to be a need for more continuity and coordination between the series of projects. By providing in the Fiscal Year 1976 Research Authorization bill (Public Law 94–475) that EPA shall develop a 5-year research plan, we have tried to encourage them to proceed in this direction.

Finally, Mr. Chairman, I would like to discuss the research project now underway in Houston. This work is being carried out as a result of a provision in the Clean Air Act Amendments of 1977 (section 403(d) of Public Law 95–95), which calls for a study of gulf coast air pollution problems. Funds for that study have been authorized by the Science Committee. We had hoped that this could be an exemplary project in which Federal, State, local and private cooperation could be demonstrated. Such cooperation could lead to better acceptance of the results of the research and, more important of course, better acceptance and implementation of any subsequent pollution control measures found to be necessary. We were hoping that interested local groups would participate in a constructive way in the Federal program. Unfortunately, I have to say that as of now the degree of cooperation has not met my hopes, and that it appears that the lack of full cooperation is at least partly and perhaps totally the responsibility of EPA. That is, I feel it is incumbent upon the agency to seek out the citizens, not for citizens to have to travel, for example, from Houston to the relevant EPA laboratory in North Carolina to make their input to the research planning and evaluation. A particular problem has been the insertion of the EPA Region VI office between the interested Houston groups and the Office of Research and Development. Forcing communication through the regional office seems to have made it slow and tenuous. We intend to look into this matter again in the next Congress and take corrective action if necessary.

Mr. Chairman, I commend this record to you and to other members of the committee.

Sincerely.

George E. Brown, Jr.,
Chairman, Subcommittee on the Environment and the Atmosphere.

SPECIAL URBAN AIR POLLUTION PROBLEMS

Part II—Houston

MONDAY, NOVEMBER 21, 1977

U.S. House of Representatives,
Committee on Science and Technology,
Subcommittee on the Environment and the Atmosphere,
Houston, Tex.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 101 of the Texas School of Public Health Building, Hon. George E. Brown, Jr., chairman of the subcommittee, presiding.

Dr. Pier. I am Stan Pier, with the School of Public Health, and you'll hear further from me later, but at the moment all I would like to do is to extend a welcome to this distinguished group on behalf of the School of Public Health and the University of Texas Health Science Center in general. For those of you who've come out of State, I'd like particularly to welcome you to Texas, the largest glacier-free State in the Union. I know that you'll have a productive day here and we look forward to this entire morning. Thank you.

Mr. Brown. This morning, the Subcommittee on the Environment and the Atmosphere of the Committee on Science and Technology is having the second day of 2 days of hearings on special urban air pollution problems. We had the first day of the hearings up in Denver, where despite all of their favorable environment they still seem to have some serious air pollution problems somewhat different from those that are common to the rest of the country. This subcommittee has jurisdiction over the general problem of environmental research, including air pollution research, and we are here today basically, in our oversight role, to determine the adequacy of our knowledge base in the particular area of regional air pollution problems.

I want to emphasize that our concern is primarily with research and that as a committee we are not directly responsible for regulatory legislation *per se.* We are concerned with all of the research activities of the EPA, including that which is conducted in support of regulatory actions and policies as prescribed in the Clean Air Act and in other laws. Thus, we must be cognizant of the regulatory needs which drive the agencies' research programs. The general problem that we want to discuss today is how specialized local problems can be fitted into a national program of research, in particular, air quality research. Clearly, we want to have air quality standards which are applied equitably through a national program. On the other hand, one can imagine that local factors, such as geography or special emissions, for example, might exacerbate certain pollution effects. Therefore, we want to consider whether or not there is adequate research directed toward such questions.

Of particular interest here is how shall we implement section 403(d) of the Clean Air Act, which directs the EPA to conduct a study of air quality in the gulf coast region, including an analysis of the fine aerosols problem and their impact on the public health. This study is very important in itself, and we will be particularly interested in watching it as an example of Federal, State, and local, and private cooperation. Finally, I want to say that we are very glad to be here; we appreciate the welcome from Dr. Pier and the general hospitality that we've experienced since we've been here. We have had an enthusiastic welcome insofar as it may be judged by the large number of people who expressed a desire to testify. We have not been able to accommodate all of them, and I will apologize for any who wanted to testify and are not included.

I would make it clear that this is not deliberate, it is just the normal foul-up of scheduling which happens all the time, and that if anyone who has a contribution to make and is not a part of today's schedule wishes to submit a statement for the record it will be included in full in today's hearing record as if it had been presented. If it is of sufficient importance we will arrange for further hearings at a later date to try to accommodate the individual or groups concerned. Now, our first witness this morning was scheduled to be the distinguished attorney general of the State of Texas, Mr. John Hill, and his office has been involved in many matters involving air quality and of course his insight would have been particularly useful. In his absence, which I understand is unavoidable and due to litigation of an important nature, his testimony will be presented by Mr. Troy Webb, so I will ask Mr. Webb if he could come forward at this time. And we're very happy to have you here, Mr. Webb, in place of the attorney general.

Mr. **Webb**. Thank you, Mr. Chairman. I do regret that Attorney General Hill was unable to be here, but as you indicated he was ordered, somewhat at the last minute, to be in court in a matter of great importance to the State, and we do have a prepared statement that I have furnished your staff. And, not being the attorney general, I'm not going to take a great deal of time. I'll just very briefly summarize for you, Mr. Chairman, what the attorney general's comments are generally.

Having been deeply involved in air pollution enforcement over the past 5 years, and having had a very aggressive enforcement policy working often in conjunction with the city of Houston and Harris County, it has become obvious that the air pollution problems here in Houston far transcend the five criteria pollutants and their control strategies, and that our problems are different from those that are found in Los Angeles and those that are indicated by studies in other metropolitan areas. And so the need for regional research has been amply demonstrated, particularly into the problem of aerosol haze.

I will leave it to the Texas Air Control Board to go into the more technical details, but, Mr. Chairman, I do want to personally convey the attorney general's thanks and our thanks on his staff for the efforts that you have given to see that we can get some regional research, and it is our hope, and we feel that your presence here today indicates that we can put behind us some of the past disputes that we have had over control strategies and various problems here in Houston and go on about the business of determining what is causing our air pollution problem and proceeding vigorously to solve it. Thank you, Mr. Chairman.

Mr. Brown. Thank you, Mr. Webb. Our next witness this morning will be Mr. Bill Stewart, who is executive director of the Texas Air Control Board. Mr. Stewart, we are pleased to have you here and look forward to your testimony helping us to understand the problems of the area.

Mr. Stewart. Mr. Brown, Mr. Wirth, and members of the staff. I have a prepared statement, which you have, and I will be speaking from that.

[The prepared statement of Mr. Stewart follows:]

PREPARED STATEMENT OF BILL STEWART, P.E., EXECUTIVE DIRECTOR, TEXAS AIR CONTROL BOARD

I appreciate very much the time you have taken to come to Houston in order to receive testimony on how research efforts can help us understand the air pollution problems of this region. I also appreciate the opportunity to present the Texas Air Control Board's viewpoint on how these research efforts should be directed.

Mr. Brown, we have one member of our Air Control Board in the audience this morning, Dr. Jack Killian, who's a licensed M.D. in the State of Texas. He is here to assist in any way possible.

Houston is a heavily industrialized region, and a tour through the Houston ship channel area is impressive. The figures are impressive also. Over 40 percent of the United States' petrochemical production is here, along with over 20 percent of the U.S. petroleum refining capacity. Though generally well controlled, the emissions from this industrial base are of sufficient magnitude to render the local air pollution situation very different from any other portion of the United States. Emissions from fixed point sources still comprise 64 percent of total hydrocarbon emissions in Houston, versus about 43 percent in the Los Angeles area.

Mobile sources emit about 35 percent of the total hydrocarbons here versus 51 percent in the Los Angeles area. Because of these differences, the minor amount of air pollution health effects data that is available from other areas of the United States may not be applicable here. We, therefore, believe that extensive research is required to determine what harmful effects, if any, air pollution is having on the more than 2 million people that reside in the gulf coast region of Texas.

Controls that have been placed on fixed point sources of hydrocarbon emissions have reduced these emissions by about 50 percent since 1971. There has been no observable decrease in either the severity of ozone peaks or the frequency with which the oxidant standard is exceeded.

The controls which have been implemented also appear to have had little effect on the aerosol haze that is so often visible in this region. The small airborne particles that cause this haze are a source of concern to all segments of the community: The citizens, the air pollution control officials, and the public health experts.

In addition to the concern about reduced visibility caused by the haze, there is apprehension over adverse human health effects that may result from either short or long-term exposure to such pollution. Unanswered questions concerning air pollution effects compound the anxiety of the residents in this area.

The information that we need in order to understand air pollution in this region covers a wide range of complex subjects. To obtain the entire amount of information that we would like to have would be a staggering task. We realize, however, that any research program must be realistic in scope. We, therefore, suggest, the following three-pronged approach.

First, an extensive project should be started immediately for the purpose of determining the major constituents and sources of Houston's area aerosols, and the geographic extent of the areas affected. From this information we would have an indication of possible control strategies and an initial indication of possible adverse health effects.

Second, a study of the health effects of exposure to the Houston atmosphere should be started as soon as possible, but only after careful planning. Many past health effects studies have been of marginal use because of the utilization of data that was either inaccurate or unrelated to any air pollution effect. The first phase of the health effects study should be the determination of the types of data that will ultimately be most meaningful in demonstrating any acute or chronic adverse health effects. Then, mechanisms to collect the data should be established. Without careful attention to these problems, any health effects study may suffer the same weaknesses that have plagued past studies. Data describing a large number of environmental parameters will have to be collected over the same time period. These two data sets can then be correlated. We realize that this will be an expensive and lengthy project. The results should elucidate adverse health effects that arise from a variety of pollutants, not simply aerosols or oxidants.

Finally, while funding limitations may prohibit it at this time, another project that must be started soon is to determine the health effects that are going to occur as a result of increasing emissions. Predicting the future is always a hazardous process, but we must try if our control strategies are going to be logical. In a study for the Governor's Energy Advisory Council conducted in 1974, we studied the historical growth patterns for this region, and the expected switch from natural gas to alternate fuels. Assuming present day control technology to be utilized, we found that by the year 2000 emissions of hydrocarbons could double, particulate emissions could be up by a factor of 8, nitrogen oxides could also be up by a factor of 8, and sulfur dioxide emissions could be up by a staggering factor of 24 times present emission rates. And, again, that's assuming current best available control technology on all sources.

We do not expect this to occur due to the improving technology that will help reduce the rates of these increases, but we use this example to illustrate the potential for problems in this region.

This year, the Texas Air Control Board appointed a panel of well-known medical experts to assist the Board. Members of this group, the Medical Resources Advisory Panel, have a wide range of expertise in public health matters. The panel was appointed because of the concern of the Texas Air Control Board with both present and future health problems that may result due to air pollution. I am confident that the members of this panel will want to assist in every possible way those responsible for the health effects research.

A mechanism must be established to assure efficient long-term research in the Gulf Coast Area because of its unique character. The many research activities that are needed cannot be accomplished over a period of one or two years. To fragment the research into a succession of unrelated, short-term efforts would be an obvious means of assuring inefficiency and probable failure. A mechanism is needed to assure the continuing and coordinated involvement of research personnel located in this region where the problem exists.

That involvement must include priority setting and review of project design. Both political and technical interest must be represented within the group that controls the research.

We understand that the design of the two initial research studies will be developed by EPA with the advice and assistance of the Gulf Coast Air Pollution Research Committee headed by Dr. Stanley Pier of the University of Texas School of Public Health. Representatives of the Texas Air Control Board, the City of Houston and Harris County air pollution control agencies, the San Jacinto Lung Association, citizens groups, the National Aeronautics and Space Administration, and the Houston Area Oxidant Study also serve on this Committee. Most of the Committee members serve in a private or personal capacity without the benefit of corporate expense accounts or any other form of funding. While we expect that this Committee will be beneficial in developing the initial studies proposed by EPA, neither this nor any other committee will be able to effectively assist with the long-term and complex research requirements without some form of continuing financial support.

We believe that a portion of the one million dollars, which we understand has been appropriated to EPA to fund Gulf Coast Research activities during 1978, should be used to defray the expenses necessary for the effective operation of the Gulf Coast Air Pollution Research Committee.

The Gulf Coast Air Pollution Research Committee should take as one of its early tasks the determination of the optimum mechanism to assure effective long-term research. The Committee itself can function to oversee research efforts for a reasonable period of time if financial support is provided and each of its institutional members recognizes its function and importance, and if its purpose and status are recognized by those other groups with which it must interact.

Most important is that we have a continuing involvement of an organization located in the Texas Gulf Coast Region, and that organization should be responsible for determining research priorities and should be empowered to coordinate long-term research projects until sufficient data are available to allow us to understand the specific air pollution problems.

As I stated earlier, it is our understanding that funds have been made available through EPA for the initial research efforts, with $400,000 to be used for the aerosol studies and $600,000 for health effects studies. While we greatly appreciate these initial research efforts, they can answer only a small portion of the questions that we have. In our opinion, the money presently available for health effects studies is enough to make only a start and more money will be needed for the future. However, only a small portion of the funding currently available could, and we believe, should be used to complete an inventory of available air quality and health effects data and to develop a comprehensive long-range research program for this region.

This Subcommittee could be of great assistance to the citizens of this region by assuring that the research efforts that are being started will be continued and will be managed so as to provide the greatest possible benefit to the public health and welfare.

Thank you very much for the opportunity to make these statements. I'm available to assist the Committee with questions, if that can be of assistance.

Mr. Brown. Thank you, Mr. Stewart. If you'll remain there just for a moment, we may have some questions. Let me welcome Congressman Eckhardt, who has just shown up and invite him to come up here and join us. Good morning, Mr. Eckhardt. We expect Congressman Gammage also.

Mr. Eckhardt. Congressman Gammage is also present.

Mr. Brown. And of course we're very pleased to have both of these distinguished gentlemen present, and I might say that in large part because of their activities that the funds that you have referred to, Mr. Stewart, were earmarked for the special purpose of the research in this region. Mr. Wirth, do you have any questions of Mr. Stewart at this point?

Mr. Wirth. Briefly, Mr. Chairman. At the start of your testimony, Mr. Stewart, you say that "we therefore believe that extensive research is required to determine what harmful effects, if any, air pollution is having on the more than 2 million people in the gulf coast region of Texas." Is there still any debate in the Houston area as to whether or not air pollution does have health impact on the people who live here?

Mr. Stewart. I think the biggest debate would be to what extent is that impact, rather than whether or not there is any impact from the pollution in this area. I think there is certainly no question in the mind of the individual citizen that resides in this area. Most of them believe, I think very strongly, that there is a problem with the health effects of the air pollution in the Houston area. Without an adequate data base upon which to make a decision an agency such as ours or EPA or others are in an awkward position of trying to assert, in fact, that there is an adverse health effect from the materials that we're seeing in the atmosphere, when in fact, the criteria pollutants as established by EPA, perhaps, are not being exceeded in the area except for the photochemical oxidant.

Mr. Wirth. The reason I'm asking, is that we just had hearings in Denver on Saturday, and whereas 5 years ago you would have had a debate as to whether or not there was a health impact, that issue is gone, and everybody agrees that it's there and the question now is how severe is it and what are we going to do about it. And that's why I was questioning your comment, "what harmful effects, if any"—there really isn't any debate, is that correct?

Mr. Stewart. I believe the major debate would be not whether there is zero health effects but at what level do the health effects begin and then how severe are they with the pollution that's in the atmosphere.

Mr. Wirth. And do you have a sense that that's pretty well understood by the citizenry here, so that the kinds of activities or the kind of action program that might be put together related to the health impacts would be supported by the people living in the greater Houston area?

Mr. Stewart. There's no doubt in my mind that the citizens of this area are concerned about it and would very definitely support an effort to try to determine and try to alleviate the problem; yes.

Mr. Wirth. On that front I think these things are very interesting and in a comparable situation we can learn one from another. We have found out in Denver that, generally, the people of the metropolitan area are probably way out in front of the industry groups and the automotive industry. Our problem there is primarily an automobile problem, but the people are just very, very far out in front of those industry groups that are going to have to catch up with what people want to have done. Thank you very much.

Mr. Brown. Mr. Eckhardt, do you have any questions of Mr. Stewart?

Mr. Eckhardt. I have none at this point.

Mr. Brown. Mr. Stewart, I think that your statement very adequately outlines the regional problem here, and it is a little frightening when you look at the future. I was struck particularly by your description of the possible increase in SO_2, which probably would mean a similar, parallel increase in sulfates and other related derivatives of the sulfur compounds. And I think it is correct to say that we do not have a sound data base as to the health effects or other effects of that kind of increased concentration of sulfates. I'm reminded that EPA did conduct a national study of the health effects of sulfur dioxide several years ago, the so-called CHESS studies, in a number of communities. And the general reaction in the scientific community to that study was that its scientific structure was sufficiently flawed that the data really wasn't conclusive as to the health effects. Do you think there's a possibility that this area could become a guinea pig for a more definitive, properly designed, thoroughly adequate from a scientific basis study of the sulfate problem if it appears that that is going to be a major item in your air pollution problem?

Mr. Stewart. Yes, sir, I surely do. Let me tell you basically why. The Houston area, as most of Texas, is unique in the sense that we have historically had a supply of natural gas upon which to base our fuel consumption and fuel burning. As you are well aware, that base is no longer there and, in fact, the sources in this area are beginning to convert to higher sulfur fuels. Houston would be unique in the sense that we have a heavy industrial base, there basically is very little sulfate in the atmosphere and in the future we are going to have it.

so to me it would be an ideal place to do that type of research, very definitely needed.

Mr. **Brown**. Well, I might say that that problem ranks very high in priority to the Nation as a research problem, in view of the probable need to convert to fuels which will produce sulfur in the atmosphere over the next generation. And you are now facing that problem now, as you have to move from your natural gas economy to a coal or lignite economy.

Mr. **Stewart**. Yes, sir, we surely are.

Mr. **Brown**. Mr. Spensley.

Mr. **Spensley**. Yes, Mr. Stewart, you mention that the Texas Air Control Board has appointed a panel of well-known experts. Is it your intention that that panel will work with the EPA team in doing these studies?

Mr. **Stewart**. Yes; I would very definitely. Through the efforts of Dr. Jack Killian, who is the M.D. on our board, we would offer the services of that group to work with EPA in whatever way it can in determining health effects data needs, as well as reviewing data, and doing other things that would help with that entire capacity. The air control board stands ready to assist in any way we can, whatever the effort might be.

Mr. **Brown**. Mr. Stewart, just looking around us here, it would appear that the resources for a major attack on understanding of the health effects of air pollution exists right here in the region. For example, I'm sure this hospital, all of the hospitals in the area and the medical profession, have at least some understanding of the carcinogenic and the pulmonary effects of air pollution, and that there are tremendous resources here to structure a scientific health effects study. Am I correct in that?

Mr. **Stewart**. Yes, sir, you certainly are. And I think that, again, that one of the reasons that we're addressing this committee in terms of trying to maintain or establish and maintain some localized base that is in this area, that we'll live here, be here and reside in this area to assist and help carry out some of this effort. I think that's very important.

Mr. **Brown**. That seems so logical to me that I can't understand where the objection to it might come from.

Mr. **Stewart**. Mr. Chairman, I don't believe there is objection. I believe the problem, perhaps, is getting the mechanisms to establish that and to assure that there is a long-term, continuing effort. We would encourage the committee to assist us with that very point and in establishing with EPA the priorities of how to proceed—as to how is the proper way to do it.

Mr. **Brown**. I think that we'll be able to be of some help in that, Mr. Stewart. Any further questions? Mr. Byerly, do you have any questions? Mr. Clement?

Mr. **Stewart**. Again, Mr. Chairman, we appreciate your coming to Houston. Thank you.

Mr. **Brown**. Thank you very much, Mr. Stewart. Mr. Eckhardt, before we introduce the next witness, would you care to make a statement on the hearings at this time?

Mr. **Eckhardt**. Mr. Chairman, we tremendously appreciate the effort that you and your committee have made in making available funds in an area we think is so essential, and I think I can speak for my constituents here and other persons in Houston to say that we very much appreciate your holding the field hearings here. Your questions of the last witness indicate a sympathetic knowledge of the situation that exists in this area. My statement will be brief, because I prefer that those with technical expertise, be afforded ample time. It appears to me that there are two definite aspects of this gulf coast research study which are most important. One is the health effects of pollutants, about which we know little, such as fine particulate matter and carcinogens. Second, the case of photochemical oxidants, the role that nature plays in the creation of this pollutant, the extent to which man should control emissions of its precursors.

With respect to small particulates, Charles Barden, until recently the executive director of the Texas Air Control Board and now a consultant in private industry and a man who was most competent and thoughtful and progressive in developing and identifying our problems here in Texas, testified before your subcommittee last February and pointed out some of the problems. He indicated that limited research done by his staff shows these particulates to be composed of sulfate and nitrate aerosols. From this research Barden deduced that these pollutants are not so much generated by emissions from smoke stacks as from an agglomeration of gaseous emissions from the automobile. However, a great deal of more research is needed on this matter, not only to determine where such pollutants are originating but how they can be controlled and what their effects upon human health are.

The second facet of the study should deal with a problem which has concerned me a great deal for several years—photochemical oxidants. The San Jacinto Lung Association, whose foremost interest is reducing respiratory ailments, has had an Air Conservation Committee functioning for many years. For several years I was a member of that committee and still have a member of my staff representing my office on the committee. One of the committee's concerns has dealt with the photochemical oxidant problem, and it has emphasized consistently that the problem in Houston is not the same as the problem Los Angeles is experiencing. Your last witness, of course, pointed out that the proportion of the total pollution is much more heavily from industrial plants here than in Los Angeles. Another difference is, of course, that the Los Angeles area is in something of a bowl with mountains surrounding several sides of that bowl as I understand. Our problem here is that normally we have southeast winds which vie with the frontal systems coming from the northwest. And frequently these winds clear out the area, but on occasion this vying force, when it results in a draw, creates a kind of stationary front situation or an occlusion, which creates something of the same situation that I imagine you have in your own area. However, the factors are different. The contributors to pollution and the nature of the weather systems and the situations topographically are quite different and, we find that some of the things that seem to have worked in the Los Angeles area may not work in Houston.

Dr. Richard Severs, of the School of Public Health and also a member of the Air Conservation Committee of the Lung Association, raises another interesting question concerning the origins of photochemical oxidants. On December 14, 1976, Dr. Severs testified at the public hearing held by the Environmental Protection Agency on proposed amendments to the hydrocarbon/photochemical oxidant strategy. His research indicates that the photochemical oxidant problem may not be caused by emission of hydrocarbons but by emissions of oxides of nitrogen, about which very little is known. His position was supported by Dr. Albert Randall, at that time director of the public health for the City of Houston. Dr. Randall pointed out that control measures imposed upon both stationary and mobile sources had resulted in a 40-percent reduction in total hydrocarbon emissions. Now, one would think that a reduction of that great an amount in emissions would have resulted in some reduction in the photochemical oxidant pollution. Such is not the case. In fact, in a letter dated November 22, 1976, to the Air Control Board, Kenneth W. McKenzie, Jr., Chief of the City Air Pollution Department, pointed out that the Houston area had its worst case of photochemical oxidant pollution ever during the summer of 1976. Oxidant pollution exceeded 0.2 parts per million during 30 percent of the days in September and more than 25 percent of the days in August. Dr. Randall, in his testimony last year, reported that 1976 showed more high ozone days than any other year since adequate monitoring results were obtained.

In view of the current uncertainties concerning photochemical oxidants, I handled the amendment to the Clean Air Act which provided additional time to reach the health-related ambient standard for photochemical oxidants, and such provision became law. Under the amendments signed into law in August, areas with severe photochemical oxidant problems, such as Houston, were provided significant leeway until December 31 of 1982. However, in July of 1982, States with severe oxidant problems must come forward with the revised implementation plan containing enforceable measures to achieve the primary standards for oxidants by 1987.

In developing this clean air regulatory strategy, with the input of State officials, it was my intent that intensive research concerning oxidants during the next several years would make it possible to develop an effective oxidant control strategy by 1982. I believe that such research should be given a high priority in the Gulf Coast research program.

I would also like to touch briefly on three other points. First, to be able to continue the economic prosperity which the Houston area has enjoyed, we must find research answers. If emissions of oxides of nitrogen are the chief culprit in producing photochemical oxidants, I think we must look at the question of what kind of controls we place on other emissions. Though I am an adamant supporter of environmental quality, one must push as rapidly as possible to identify that type of pollutant which, if reduced, will have the greatest efficiency in reducing oxidants in this area. As has been said here, we are in a situation of very quickly moving from a gas fuel base to a coal base, and we do have considerable pressures on development of industry because of that fact. So it becomes extremely important that the most careful scrutiny and the most precise identification of the cause be determined as quickly as possible.

The second point I wish to make is to strongly emphasize that this research study must not be a one-shot affair. As this subcommittee has wisely recognized in the conference report of the fiscal year 1978 EPA authorization, such research must be an ongoing project. I do not believe that the answers we need can be obtained within a short period. I will ardently support all efforts to provide adequate funding until the answer is obtained.

Finally, I want to commend the Environmental Protection Agency for proceeding rapidly with the study. Already two meetings have been held with interested agencies and citizens' groups in efforts to determine the direction of the study. I would encourage the EPA to use whatever data is already available rather than to duplicate research that already has been done. This research study must be coordinated with such groups as the Houston Area Oxidant Study, and the San Jacinto Lung Association, as well as the Texas Air Control Board. I would like to see a liaison committee established by the EPA, to keep interested groups informed as to the progress being made in the study.

Again, I want to thank you for coming to Houston and listening to our problem; it is my hope that the hearing today will help to provide a consensus as to research priorities and facilitate the type of communication which is so essential to an effective research program. It is my intent that the Gulf Coast Research Program will further the public health and improve our clean air regulatory program. Thank you very much, Mr. Chairman.

Mr. BROWN. Thank you, Mr. Eckhardt. I appreciate your statement and I would reiterate that your support for adequate research in general and for the needed program for this area has been extremely important in developing the program to the point that we have today, and we hope even more in the future. Mr. Gammage, would you like to make a statement?

Mr. GAMMAGE. Thank you, Mr. Chairman, I'll be very brief. I'd like to welcome the committee to the Houston area, the greater Houston area, and specifically the 22d Congressional District today. I appreciate your coming here to pave the way for the regional study and the regional redirection of EPA in the area of air pollution. I think my colleague and friend, Congressman Eckhardt, has adequately pointed out the necessity for this redirection and obviously the committees of the Congress and the Congress saw the necessity for this effort and also, and more pointedly, their cooperation with State and local entities that are concerned on the local scene with the state of their environment. I understand our county Judge, Jon Lindsay, is going to be the next speaker and must move on to preside over Commissioners Court, I presume over flooding and transportation, having encountered some of those problems this morning on the way here, so I'll close with that brief statement.

Mr. BROWN. Thank you, Mr. Gammage. Our next witness is Hon. Jon Lindsay, Harris County Judge, and we invite him to come forward and welcome him to the subcommittee's hearings.

Mr. LINDSAY. Thank you, Chairman Brown and members of the committee. And, Bob, it's true—that's why I was late, too. I got stuck in our own flood and traffic jam and it was something fierce this morning. I think, as I came in, there was a little confusion about what the County Judge is in Texas. A very brief explanation of that might be just to tell those it is the chief administrative office of the county that is elected in Texas—I don't know what it is in California, but I'm sure you have a similar position there.

Mr. BROWN. The Lord appoints them in California.

Mr. LINDSAY. It's not that way here.

[The prepared statement of Judge Jon Lindsay follows:]

STATEMENT BY HARRIS COUNTY JUDGE JON LINDSAY TO THE SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE

Gentlemen, first let me thank you for taking an active interest in the pollution problems in the Harris County area. Harris County is a rapidly expanding area. Approximately 80,000 people moved into the county last year alone. These people are coming here to take advantage of an expanding job market that has its roots in the vast petrochemical industries of the region. Harris County is unique because there is probably no other region in the world that has a similar industrial complex. We therefore have pollution problems here that are equally unique.

I hope that your presence indicates that the Environmental Protection Agency will direct its research efforts to the problems of the local area. Hopefully they will not set across-the-board-standards that might apply in the East or in Denver, Colorado, and therefore not be feasible here.

Three obvious problems involving our area with corresponding research needs are immediately apparent:

(*a*) The little understood and all pervasive oxidant problem,

(*b*) The aerosol haze, and

(*c*) The increasing sulfur dioxide concentration being added to our already polluted air.

1. Our ambient air levels of oxidants (as measured by ozone) regularly violate the national standard. This condition exists in spite of millions of dollars having been spent at the insistence of EPA to control hydrocarbon emissions. Our oxidant episodes are no less frequent and no less severe today than they were several years ago before controls had been implemented removing thousands of tons of hydrocarbons from our atmosphere. Obviously this strategy has not been effective, yet the EPA persists in requiring further reduction of hydrocarbons without proof that further reduction will improve oxidant levels. Apparently it has not occurred to the EPA that the oxidant standard may be improperly set. We would recommend research be directed toward developing a proper oxidant standard. Research is definitely needed to explore the enigma as to why oxidant levels are not reduced as hydrocarbon levels are reduced. In addition, measuring oxidants by measuring ozone has obvious drawbacks which are becoming more and more apparent.

2. Aerosol haze plagues the Harris County horizon. Its origin, its composition and its effects are equally unknown. As a visibility problem it is substantial and it appears also to impair health. Health effects have gone almost totally unexplored. The need to do lengthy and indepth research cannot be questioned. The question is not "does the Harris County haze need to be studied?" but rather, "How soon can the study begin?"

3. Local sulfur dioxide measurements do not approach levels of noncompliance; however, it is reliably predicted that conversion to fuel oil and coal will probably cause the Harris County area to become noncompliant. Coupled with an increasing sulfur dioxide concentration will be health problems, some caused directly by sulfur dioxide, some caused by a synergistic effect due to the presence of other airborne pollutants. The devastating effects on pulmonary conditions caused by sulfates (sulfur dioxide is a precusor) is just beginning to be understood. I call to your attention the research done by Dr. Judith Graham of the EPA.

A second purpose of this hearing is to discover how local groups can have input to the research planning.

During the past 2 months several meetings have been held between interested local parties and representatives of the Texas Air Control Board and EPA. At a meeting on October 19, 1977 in the local offices of the TACB, attended by 28 persons representing a cross section of vitally interested parties, a liaison committee was formed. The function of this committee is to have informal and unofficial input to the EPA regarding the research studies to be conducted in the

Gulf Coast area. At the time of formation it seemed apparent that the EPA is not eager to have outside guidance, yet I believe local input on a continuing basis is an absolutely necessary ingredient to the success of any research program conducted in this area.

This committee has no official standing, but the membership represents local and State government, organized research, medical agencies and environmental groups. It is our desire for this committee to be officially recognized and to be able to interrelate on a positive basis with the EPA.

We live with our pollution problems on a day-to-day basis and have an understanding bred of familiarity. That our resources are not sufficient to totally deal with our pollution problems should not exclude us from having a say in the solution to these problems. Because EPA has the personnel and the equipment and the financial resources to deal with problems of such magnitude as found locally, it logically places them in the research role, but local input and cooperation is vital to success. I therefore respectfully request that this committee, as shown by the attachment, or a similarly constituted committee be given official sanction and granted an advisory role to council with the EPA in directing the research activities to be conducted in Harris County.

The EPA has a propensity for demanding specific action to cure a given condition without fully understanding the causative factors leading to that condition or the impact of the action required. The classic example of this, of course, is the oxidant reduction strategy which has cost millions of dollars and has not reduced the oxidant level in this area. The EPA has a "cart before the horse" philosophy which leads to coming up with answers and then trying to fit them to likely problems. We have had enough of that and yet, if I understand the Clean Air Act Amendments of 1977, we are probably faced with more of the same.

We have a golden opportunity as concerned, intelligent citizens to sit down together and explore solutions to our air pollution problems and then working together in full cooperation to solve those problems as the facts developed by research dictate. Think how much we can accomplish if we approach this situation without bias, without preconceived opinions and without individual selfishness.

Thank you, Mr. Chairman, and members of the committee.

LIAISON COMMITTEE FORMED ON OCTOBER 19, 1977

Dr. Stanley M. Pier, chairman, University of Texas School of Public Health; Dallas Evans, City of Houston Air Pollution Control; Allison R. Peirce, Harris County Pollution Control Department; Jim Payne, Texas State Air Control Board; Mary Rollins, Citizen's groups: League of Women Voters, Citizens Environmental Coalition, Citizens Clean Air Advisory Committee; Larry Feldcamp, Houston Area Oxidant Study; Dr. Richard Severs, San Jacinto Lung Association; Unnamed, Harris County Medical Society; ex officio Ray Lozano, Federal EPA (Dallas); ex officio Robert Rowley, Federal NASA.

Mr. BROWN. Thank you very much, Mr. Lindsay, for your statement. Mr. Wirth, do you have any questions?

Mr. WIRTH. Thank you, Mr. Chairman. Mr. Lindsay, on the second page of your testimony you talked about how EPA is persisting in requiring further reduction of hydrocarbons without proof that further reduction can improve the oxidant level. Does the EPA have other reasons for pressing for the reduction of hydrocarbons other than just the improvement of oxidant levels?

Mr. LINDSAY. Well, I'm not sure what their reasons would be. I'm assuming that they would, yes.

Mr. WIRTH. Isn't EPA probably after a whole variety of pollutants in the air? They're going after various nitrogen oxides and various sulfur oxides and particulate matter, looking at these and the relationships between them. I guess it's unclear as to what the relationship of all of these may be. I would suspect that what EPA is trying to do is to bring the whole level of air pollution down, and the level of oxidants, albeit the biggest problem here right now, is one of many problems that the EPA is trying to address.

Mr. LINDSAY. Well, I believe they're taking a kind of shotgun approach, and they're shooting at everything and there may be a more economical and more reasonable way to pinpoint, through research, what some of the problems are and then go towards the prime pollutants and working in those areas that do seem to have the most impact on the pollution in our country. And, of course, this is what we're encouraging.

Mr. WIRTH. Well, now, understand that we want to pick off the most important one and that problem would exist here as in other cities like my own city of Denver. But I would also say that it's important to look at everything the EPA is trying to do. Albeit we may not agree with or we may not like what EPA is trying to do, probably they're on the right track in a lot of things. It's easy to take a shot at what EPA's trying to do. They haven't solved it all today as you know. We can get angry at that, but on the other hand I think we want to try to understand the overall impact of what they're doing.

Mr. LINDSAY. I think, as Congressman Eckhardt pointed out in his statement, that there are certainly other things to consider in our community. We do have an economy to consider, and by taking a shotgun approach we may be stopping economic development of any kind if we're not careful. And we need to be objective in the sources that we're going after, I believe, in order to hold the confidence of not only the people that we are providing the protection for, but also the industries that are providing the jobs for those same people.

Mr. BROWN. Mr. Eckhardt?

Mr. ECKHARDT. Mr. Chairman, I know that Judge Lindsay is one of the persons in Harris County who has been most vitally concerned with environmental matters—I think mostly the question of preserving the streams. I have been associated with him in some of those endeavors. What I say here is not critical of his base, but I do think it might be a little unfair to blame EPA too much in this area. It's not usual for Members of Congress to say, "Look, why don't you throw a little of the blame on us. Maybe we had to guess at a time and then we had to reconsider and take further action." But you say, judge, "if I understand the Clean Air Act Amendments of 1977, we are probably faced with more of the same"—driving in a given direction that may or may not produce results. I guess that's what you meant—is that right?

Mr. LINDSAY. Well, that's kind of what I meant. I hope I'm wrong on that, though.

Mr. ECKHARDT. Well, I think you may be. I think EPA was actually required, under the statute, the Clean Air Act, which we drafted, to put into effect some kind of rather stringent limitation on further building of facilities in a noncompliance area when the ambient air standard levels were not met in 1977. Now, we wrote that into law and EPA was doing what they felt the law required. And they provided a certain degree of leniency which may somewhat have stretched the law in what is called the offset policy, which has been much criticized. So in the 1977 act, we recognized that there always must be a goal and an estimate to reach in obtaining clean air. Recognizing that such goal may have been too tight, we provided for further flexibility with respect to six pollutants, and provided that the ambient air standards be met by 1982, and in the case of oxidants and carbon monoxide by 1987 at the latest. Now, I think this may answer the statement you made on page 2 that apparently it has not occurred to the EPA that the oxidant standard may be improperly set. It certainly was recognized by Congress—and by my colleague, Bob Gammage, who was one of the first to point this out and to raise this question in committee—we together worked on amendments in that commitee and ultimately on the floor. EPA was pretty much bound to operate within the original statute. Now, of course, with a further extension of time to meet the oxidant standard, we are here trying to point out that we want to get the necessary research so that in placing limitations on industrial emissions, we won't actually stymie industrial growth.

I hope that EPA is as concerned about this question as you and I are, and I'm quite sure that our committee will be watching its progress in trying to identify the culprits here and to take that kind of regulatory action which attains the maximum cleanup of the air while at the same time affording the minimum of limitation on industrial growth in the area. Incidentally, I might mention that in the new Act we provide that any State may put into effect the California standards with respect to automobile emissions, and a little tougher standard on automobile emissions may give us a little more leeway and flexibility in industrial growth.

I have more made a statement that I have asked a question, but if you'd like to comment, please do so.

Mr. LINDSAY. Well, I think I have little comment, except I am encouraged with what appears to be a changing attitude or more direct influence from Congress on EPA than has been in the past, and I look forward to that continuing in the future.

Mr. ECKHARDT. Thank you, Judge. Thank you, Mr. Chairman.

Mr. BROWN. Mr. Gammage, do you have any questions?

Mr. GAMMAGE. Thank you, Mr. Chairman. If I read him correctly, what Judge Lindsay is alluding to is a disgruntlement and disenchantment of local people on both sides of various regulatory issues. It's not what EPA is doing so much as how they're going about it. In all deference to the Agency, however, Judge, it should be clarified that the offset policy that many people find so onerous was an effort on the part of the EPA—which they technically really had no authority to do—to get out from under a very arbitrary standard that was established in law in order to permit whatever growth they could in those noncompliance areas by allowing offset, which was not provided for in law. In this session of Congress we did recognize that offset, and, I think, made it a little more flexible. I believe the Congress has recognized the fact—and we made a point of it on both sides of the Rotunda when this legislation was being considered—have recognized that nationally imposed standards don't necessarily get the same results in one area of the country as in another. What is true in Los Angeles or St. Louis may not be true in Houston or elsewhere and that there must be regional redirection as far as establishing how can we get where we want to go while balancing environmental integrity and economic development in these communities.

It was brought to their attention very suddenly and with great impact when it was realized that any national energy policy that is established by the Congress in this session or any other is going to require substantial conversion to less clean souces of energy. Therefore, we need to be concerned about our environment more than ever but we also need to consider economic impact—in that reference, I would refer you to some remarks on page 514 of the committee report on the Clean Air Act—at that particular point in time they were unfortunately minority remarks, but I think they were more or less adopted by the Congress when the final bill came out. No one has a right to expect that the Congress should always make perfect and timeless statutes, but the citizens have a right to insist that the Congress should bring its laws into compliance with economic and physical realities and the dictates of common sense. I think that's what the citizens want, and I think that's what you're talking about, and I think we're moving in that direction with this regional redirection and in appearing here today.

Mr. Lindsay. I certainly am encouraged myself, and I think the main point, of course, is that we are emphasizing local input to research that does go on and I think that's the most important part of my statement. We do have expertise in Harris County and Texas area—they're qualified, they've done a lot of research on their own, but they unfortunately do not have the monetary facilities to do everything that's needed. With the Federal Government's help, perhaps, we can work together and solve our problems. We have to find out what our problems are, first, though.

Mr. Brown. Well, we appreciate that statement very much, Judge Lindsay, and if there are no more questions we will let you get back to work.

Mr. Lindsay. Thank you.

Mr. Brown. Our next witness this morning will be Dr. Stanley Pier, School of Public Health at the University of Texas, one of the experts that I hope we can count on to solve some of these problems.

Dr. Pier. Possibly the most important part of my statement is this: The lady who is attempting to record these proceedings for the record has asked for you to speak into the microphone or we will not pick it up. We are not having trouble from the podium, but we are having trouble from the table.

[The prepared statement of Dr. Pier follows:]

STATEMENT OF STANLEY M. PIER, PH. D.

My name is Stanley M. Pier. I am an Associate Professor of Environmental Health at the School of Public Health, The University of Texas Health Science Center at Houston. I serve on the Technical Advisory Committee and the Medical Advisory Resources Panel to the Texas Air Control Board. I also serve as the Chairman of the Gulf Coast Air Pollution Research Committee to the Environmental Protection Agency, an entity very recently established to work with EPA in formulating the research programs mandated by the Clean Air Act Amendments of 1977 and the subject of this hearing.

I have noted these affiliations only by way of establishing some credentials for appearing before this Committee. The views which I will express here this morning are however those of a private citizen—hopefully an informed one—and do not necessarily reflect the views of the Texas Air Control Board or The University of Texas. However, the statements which I shall make do have the concurrence and sanction of the EPA liaison committee to which I have referred.

In addition to the associations which I have mentioned, I serve as a consultant to the National Institute for Occupational Safety and Health, the Pan American Health Organization of the United Nations World Health Organization, the National Aeronautics and Space Administration, and the American

Petroleum Institute. All in all, I have spent much of my professional career in the field of the health and ecological effects of environmental stress, including air pollution.

I have lived in Houston for almost 11 years, and I have been directly involved in our air pollution problem for all of that time. Houston does have an air pollution problem. We have industrially generated odors which particularly affect the eastern areas of our city. We exceed the ambient air quality standards for particulates and oxidants frequently for whatever that may mean in terms of human health. We have a distinct problem of visibility impairment, a condition generally perceived by the general populace and which may or may not have health impacts. Finally, we have long periods of high temperatures and humidities. Looking into the future, we can anticipate a possible new problem—that of increasing levels of sulfur dioxide produced by a conversion from gas to coal for industrial use and electric power generation, as may be required by legislation to deal with our energy problem.

I should like to address several of these problems.

First, the matter of airborne aerosols. These solid particulates and liquid droplets are readily perceived by the populace and really constitute the major evidence of air pollution to most people. Both natural atmospheric processes and human activities produce these aerosols, and it is imperative that we determine what these are and how they arise. The contribution of humidity is significant—and uncontrolled.

Airborne particulates have been monitored longer than any other pollutant. Yet we must now recognize the most generally used technique is not directed toward public health. Pollution monitoring by high volume air sampling fails to determine the most important component of airborne particulates, those falling within the respirable range. We must study the suspended particulates in the Houston environment and determine the extent and composition of the respirable fraction, with special emphasis on the degree to which this fraction is composed of toxic components or materials capable of interacting with and potentiating the action of irritating gaseous pollutants. We must also determine the origin of the respirable aerosols, including contributions of biogenic materials such as sulfates from our coastal zones and the products of photochemical reactions of hydrocarbons produced by vegetation. Once the aerosol fraction of our atmosphere has been characterized, some assessment of health impacts should be possible. Work such as this should put our haze problem into perspective, and establish whether we are dealing with a health problem or a more readily tolerable esthetic degradation, or some combination of the two. As of now, we simply don't know.

The oxidant problem is a major point of contention and the three previous speakers have already alluded to this. We are designated a nonattainment area. This despite the fact that we don't know what we actually have in our atmosphere, we don't know where it comes from, we don't know if the measurement technique is applicable, we don't know what the health effects are by whatever we have and we don't know if compliance is realizable with even the most extreme control measures. We do know however that the control measures proposed are costly and disruptive.

The ambient air quality standard for oxidants was established with a measurement technique which measured the total oxidizing capacity of the atmosphere. It was recognized that oxidants were a complex mixture, of which the major constituent was ozone. At the current standard, some 50–60 percent of the total ozone permitted is of natural origin. Because of difficulties with the original analytical method, we are now monitoring compliance with a method that measures ozone. The assumption is that all atmospheres have roughly the same mix of ozone and oxidants as in Los Angeles, where the basic data were developed. This fact has certainly not been demonstrated with respect to Houston's air. Nonetheless, the same strategies for control developed for Los Angeles are being imposed on Houston.

Research done at this institution points up serious problems with respect to the relationship between the two analytical methods, the one which formed the basis for the standard and the one in current use for enforcement. These data have been provided and have been dismissed as "operator error," a resolution which we cannot accept. However, this matter demands resolution in the forthcoming research program. The fact that the original analytical method, which established the standard, is designated as "unreliable" in the revised oxidant document now under development by EPA does not give much cause for encouragement. If a standard was developed based on an unreliable analytical method, consideration must be given to the strong possibility that the standard too is unreliable.

There is other strong evidence that our oxidant or ozone problem is different from that in Los Angeles. We have areas in our State with hydrocarbon levels substantially less than 10% of those prevailing in Houston. Nonetheless, these areas are also out of compliance with the oxidant standard. These data too have been provided to EPA. Hydrocarbon emission reductions of the order of 95% are either impossible or intolerably costly, and if this is what is required, the standard is impossible to achieve.

Other information points to the fact that we have a different problem in Houston from that in Los Angeles. We attain oxidant/ozone levels similar to those reached in Los Angeles, at which levels there would be severe eye irritation and extensive vegetation damage. These symptoms are not experienced here. We also find instances in which there is a simultaneous increase in ozone levels across wide areas of the State, and frequently during dark hours. This is not characteristic of Los Angeles type photochemical smog. Long range transport of ozone does not explain the whole problem. We also find high levels where pollution is not an issue. All of this suggests a source other than or in addition to industrial or automotive discharges.

Just within the past week, an announcement came out of the National Bureau of Standards reporting that their scientists have discovered an entirely new and possibly very important intermediate in photochemical smog formulation. It was specifically noted that this finding could alter our computer models simulating the formation and spread of smog. This affords further evidence of the incomplete understanding which we have of this problem, and attests to the imperative of developing a better understanding before we impose costly measures of uncertain effect and merit.

Despite all this uncertainty as to the degree to which the Houston and Los Angeles problems are equivalent, we are proceeding with the imposition of Los Angeles-developed control strategies here. We need more information as to the composition and source of our ozone problem before these measures are imposed with the costs and disruptions associated with these controls. Anyone concerned with human health strives to err on the side of caution in the protection of the public health, but it seems to me that we are moving too far and too fast in the face of what seems to be a manifestly unsound basis. We must establish the nature of the Houston problem and design a remedy for Houston rather than assuming that we have the same problem as Los Angeles and that the same controls are applicable.

Our most important air pollution problem may in fact not yet exist. This involves future increases in sulfur dioxide and derivative levels as we abandon natural gas for industrial and power generation use and switch to coal. We are in compliance currently with both the primary and secondary air quality standards for SO_2, but this happy state may not continue. A critical point is that we have a population generally not acclimated to this pollutant. Further, we must anticipate human contact with SO_2 under conditions of high temperature and humidity. We do not know what this combination will produce in terms of adverse health effects, and this must be determined before we can judge what levels of sulfur oxides can be tolerated. We must also investigate possible interactions between SO_2 and ozone, even if the ozone itself has no adverse effects at present levels. We can anticipate a more rapid conversion of the atmospheric SO_2 to the much more offensive SO_3 and sulfuric acid mist. This interaction should be studied in chamber experiments. In conjunction with these, we should be determining the sulfate baseline in this area now, before a significant increase in emissions occurs, as a means of establishing man's contribution to this possibly important pollutant.

To summarize, the following are, in my judgment, the most critical research needs pertaining to Houston's air pollution situation :

1. We need to quantify and characterize the respirable portion of suspended particulates, both liquid and solid, and determine what toxic and potentiating substances may be present. This will require improved collection systems to preclude altering the aerosols during the collection phase and more sophisticated analyses.

2. We must conduct intensive analyses of the oxidant mix to detemine what portion is ozone and what portion consists of the more deleterious components such as the peroxyacetyl nitrates. As part of this effort, we must determine the origins of the oxidant precursors and define the relative proportions of uncontrollable

natural contributors and controllable man-related emissions. The most critical need is for a determination of the appropriateness of the control strategy.

3. We should establish a comprehensive health surveillance system to monitor human health as related to air pollution. We especially need to determine whether there are significant adverse health effects associated with oxidant episodes. We should also monitor vegetation more closely to detect characteristic oxidant damage—or the absence thereof.

4. The health surveillance system just referred to should be established at the earliest possible time, but certainly before there is significant intrusion of sulfur oxides into our environment. This system could serve as an early warning for adverse effects of exposures to SO_2 and derivatives.

5. Research should be conducted on the interactions or synergisms, if any, among sulfur dioxide, high temperature, humidity and other pollutants as a means of establishing the tolerable sulfur pollution levels, considering present and anticipated future technology for extraction of sulfur oxides from flue gases.

We must recognize that what I have outlined is not a one-year study. Rather, it will take an extended period of time and considerable money. Certainly the investigation of local problems at the level of the affected area is the preferred approach.

In the time allotted for this presentation, it is obviously not possible to provide specific details of research protocols. However, the Gulf Coast Air Pollution Research Committee is ready to work with EPA in the planning, implementation and evaluation of research studies in these areas. It is critical that this research be conducted with the best talent and techniques available. It must be conducted so as to find answers and not to confirm preconceptions or established positions. Only in this way will we achieve the goal to which all of us subscribe—an optimum air environment for all our citizens.

Mr. Brown. Thank you very much, Dr. Pier. That was an excellent statement, a very fine description of the research needs. I might say that if we had a program adequate to do the job that you describe, it probably would solve not only the problems you have in this area, but those in Los Angeles as well.

Dr. Pier. It would be desirable, in that case.

Mr. Brown. Well, I don't want to appear to be parochial; obviously it would have widespread national implications. Mr. Wirth, do you have questions?

Mr. Wirth No.

Mr. Brown. Mr. Eckhardt?

Mr. Eckhardt. Doctor, I just was a little bit concerned about your statement that we may be moving too fast. Do you think that we made a mistake in taking the measures that have reduced total hydrocarbon emission by about 40 percent?

Dr. Pier. No; I don't think we made a mistake. The fundamental question comes down to, what have we gotten for what we have spent? I think that the element that we have to ask for is not how much hydrocarbon or anything else we've pulled out of the atmosphere. The question is, What improvement have we made in the quality of the air? That, to me, is the important question. And the question therefore comes down to, what have we gotten for what we have spent—and I don't know what the total dollar amount is. The question is, Have we gotten an improvement in the quality of the air, and the answer that has been provided is "so far, no." We have spent a great deal of money and oxidant episodes have not been significantly reduced. I think a more fundamental question is whether oxidant is the pollutant that we should be going after. It is implicit in my statement that we have to know what the health effects of oxidant are. That there are instances of eye irritation and certainly a rather cruddy-looking atmosphere in California is incontrovertible. Do we have these here? So far we don't think so.

important ingredient that we know about? Is it representative of the total number of parties that are concerned?

Dr. Pier. The secret ingredient is money. As has already been alluded to, we have no sanction. We have no way of implementing a more formal effort—we're all doing this, along with 20 or 30 other things. If we did have some support, if we did have some capability to work closely on—not on the day to day, certainly, but on a reasonable frequency basis with EPA, which will take some kind of funding—I think we could do an effective job.

Mr. Brown. Alright. I thank you very much for your testimony, Dr. Pier, and we will look forward to working with you in the future. Our next witness will be a colleague of Dr. Pier's, Dr. Richard K. Severs, also of the School of Public Health at the University of Texas. We welcome you and look forward to your testimony.

Dr. Severs. Thank you. Chairman Brown, Congressmen, ladies and gentlemen, I'd like to take the opportunity first to acknowledge the work of this committee in connection with the Clean Air Act Amendments of 1977. I think you are to be congratulated for getting a very good set of amendments in a very difficult situation. I have a rather long statement, so with your indulgence I'll paraphrase part of it and try and skip the redundant sections.

Mr. Brown. Without objection, the full text of the statement will be included in the record at this point, and we would encourage you to make whatever abstraction from it that you care to, Dr. Severs.

Dr. Severs. Thank you. I would like to describe the problem, its effects, and possible strategies. The observed and measured differences between the Houston and Los Angeles area environments have already been alluded to many times, and they lead most of us locally to believe that major regional differences do exist. Parallel measurements of ozone and oxidants in this environment, conducted by three different teams on three different occasions, indicated disagreement between measurement techniques some of the time. This is also unlike the Los Angeles experience, where such parallel measurements are said to agree in both the laboratory and the field. The nonmethane hydrocarbon-nitrogen oxides ratios are also different than in other regions. The nonmethane hydrocarbon mix of the atmosphere has never been characterized adequately over any extended time period. And the background hydrocarbon levels differ also. We know with our piney woods here that we have a much higher hydrocarbon background than they have in Los Angeles. The Houston haze has been seen by citizens and scientists alike—we don't know what it is—but it does occur frequently during the year. And although it certainly does have some components of the gulf coast sea haze, the associated odors indicate a much more complex mixture. Technically speaking, there's a large suspended particulate nonattainment area located from downtown Houston over to eastern Deer Park. And that is above the national primary ambient air quality standards. As far as I can tell from looking at the ambient air quality data, this has been true since we began monitoring in 1968. This area contains a lower economic mixed-ethnic residential area with all classes of industry. Houston ship channel cuts through this nonattainment area. Currently, the entire region is also classified as a nonattainment area for oxidants. but other speakers have addressed this problem so much that I thing I'll leave it alone.

The most unique feature of the current Houston atmosphere will soon come to an end. Ambient air measurements reveal a sulfate level of 10–15 micrograms per cubic meter across the entire region, with few manmade sources of sulfur oxide identifiable. In most regions, sulfates are thought to be the result of conversion from SO_2 from coal-fired powerplants. Thus the Houston area has benefited from low SO_2 concentrations, while we experience a sulfate level that ordinarily is thought to be high. The probability that SO_2 will be introduced into this Houston atmosphere in the future, with new energy sources, just boggles the mind. The potential risk is vast for a population to suffer the ill health effects associated with the mixture of the known air pollutants that we have with our environmental stresses and then add sulfur dioxide to it. It should make the London disaster of 1952 look like a picnic.

The environmental degradation respects no manmade boundaries, as we've seen here. And in Harris County and the ship channel area this fact is amplified as a problem in air pollution, since we have a political problem of overlapping or adjacent jurisdiction of air pollution control districts. Without the threat of Federal intervention, the local programs, in my opinion, would not have had the success they can claim in controlling emissions to the ambient airshed. Our permit system for control of airborne emissions has been in effect since 1971 in Texas, but it only addresses the standard air pollutants. Hazardous pollutants of small concentrations, like vinyl chloride or cadmium, are just not reported. Only by special case ambient air analysis are they detected at all, and little is done with such data. However, the technical capabilities of the State and local agencies are excellent. and I think can easily be utilized with greater funding and Federal guidelines.

In the effects area, the impact of the environment on Houston population has not really been adequately assessed. The local health studies have been short, incomplete, and inconclusive. It doesn't mean we haven't done something, though. Significantly positive correlations have been found between mortality rates and suspended particulate levels, mortality rates and temperature and humidity, lower than average lung function in older workers with heavy smoking experience that live in high suspended particulate zones. And we have suggestions of significant correlations between ozone episodes and decreased lung function in asthmatic school children. And yet to be explained are the higher than the annual average population mortality rates for specific types of cancer, respiratory diseases and cardiovascular diseases. Environmental factors are known to contribute to these increased rates in other regions, but they have not been evaluated in terms of the health impact on the Houston population. Awareness of the citizens to the problems of the degraded environment is easily seen by the growth of the affluent residential areas in the northwest. This area has more environmental amenities and less obvious pollution—air or water—than any other part of the city. The flight of the middle class from the eastern portion of the city represents the negative aspect of this socioeconomic problem. The resultant dislocation of people from job sites, increased highway burdens, and changing neighborhoods are just part of the kaleidoscope of the socioeconomic problems that have not been addressed but can be seen to already exist. Clouds of haze can be seen developing in the petrochemical industrial area—if you're downtown in one of the high-rise buildings—which then sweeps across the city. The aerosol size is so small that nothing out of the ordinary is registered on the weight basis suspended particulate standard measurements.

However, it's often accompanied by noxious odors, and these complaints are registered regularly with the Houston Pollution Control Division. This is the cloud of haze that scares most of the citizens. Its color, density, origin and smell make this haze highly suspect as a determinant factor in the ill health suffered by Houston residents. The adverse impacts of a deteriorating environment are difficult to calculate or estimate with the current data bases most people have already set. The area health plans produced by the local health systems agencies may attempt such analyses in the future, since they include environmental health as an integral part of any plan to decrease disease rates and thus the cost of ill health care. However, it's a very difficult task.

What do we do? From the foregoing, it can be seen that little is known in depth about the Houston environment, including its atmospheric characteristics or about any environmental impact on the health of the community. Thus many questions are posed. The largest is what needs to be done. Current control strategies are based on knowledge being gained elsewhere, and the few facts known about the Houston atmosphere indicate regional differences exist that may make that knowledge useless or even detrimental when used as a basis for control strategies in the gulf coast. Thus, we need research. Research to characterize the environment, research to characterize the health status of the population, research to delineate the social costs of the polluted environment, and to anticipate regulatory needs and give them a strong regionally based criteria for action. The Texas Air Control Board has made excellent suggestions on the mechanisms necessary to see that this research is done adequately. I'm not going to repeat all of those research needs my colleagues have already emphasized—however, I would like to suggest some especially important considerations.

Currently, the EPA health studies have looked at air pollution alone, and I would suggest that we look at the total body burden of pollutants—whether it comes from air, water or food—as the primary basis for establishing ill health effects. I don't really believe we can split the environment into air, and water and other components—we have to look at it as a total environmental stress to the human body. And in the same way, I would characterize the research that I suggest for the atmosphere. We need to go back to base one. Currently, the EPA research studies tend to concentrate on measurement of standard pollutants that we already know cause ill health effects. Well, if you get into a region like this where we have different problems, that may not be the best approach. So I would suggest that we characterize the environment as thoroughly as possible in both chemical and physical terms. I'd like to know both the atmospheric electrical potential, the acidity of the environment, the other components—I'd like to know how much of our aerosol is a wet aerosol, how much is a dry aerosol, and so on. So I'd like to have an overall approach that's somewhat different than is characteristic now of the research that's being suggested. Now, research is expensive. And the limitations exist in the number of qualified individuals available to work on a project of the magnitude indicated, as well as the funds available. So one of the first steps needed is the establishment of a research priority list. Since conflict is bound to occur when expenditures are involved, the mechanisms should be established to see that the interested parties all have input. And I, too, believe that an informed citizens' liaison group should be appointed to represent the interests of the community being studied. These people representing not only their community but factions within that community have a vested interest in the research outcome—namely, they live in the community. This liaison committee should also have the benefit of a staff scientist. If the body is not sanctioned by some political group, I don't believe it will be effective at all.

Regional research is not a new concept. The uniqueness of the environment on a large scale has been recognized in the establishment of watersheds, regionally planned districts, meteorologic zones, agricultural land use and so on. So it's not surprising that we're seeing it appear now as a research need in air pollution, indeed in the environmental area. The mechanism for implementation of these results to national ambient air quality standards is a very difficult one. I think we certainly need to protect human health to the same necessary degree in all regions. The concept of the national ambient air quality standard has to be maintained, and still allow for the concept of regional differences. With different mixes of environmental stresses in each region, however, this does present a problem. I really can't suggest a solution to it, but I know we can't solve it by ignoring it. The total body burdens of lead, for example, comes from an intake of air, water and food, with air accounting for less than 10 percent of the average intake. Well, the last effort to pass a standard for lead—where you adopt a control strategy that only regulates air intake—is tantamount to expecting the tail to wag the dog. You just can't have regulated 10 percent of a pollutant without doing something about the other 90 percent. So, in conclusion I'd like to suggest that the criteria and control strategies developed from this research must be part of a federally orchestrated effort in which the differing agencies or divisions of agencies with environmental responsibilities must work together in order to achieve maximum meaningful and useful results. And I'd like to see this represented in the approach that's a human ecological approach in the biosphere.

[The prepared statement of Dr. Severs follows:]

Testimony presented by invitation to the U. S. House of Representatives
Committee on Science and Technology
November 21, 1977, Houston, Texas

STATEMENT OF RESEARCH NEEDS

by Richard Severs, Ph.D.
Associate Professor of Environmental Science
The University of Texas Health Science Center at Houston
Representing the San Jacinto Lung Association

DESCRIPTION OF PROBLEM:

Observed and measured differences between the Houston and Los Angeles air environments lead local researchers to believe that major regional differences exist. In the Houston area, high ozone values, e.g., 0.25 ppm hr, have been recorded without an associated brown haze, plant damage, or eye irritation complaints. This is most unlike the Los Angeles experience. Parallel measurements of ozone and oxidant in the real environment, conducted by three different teams on three different occasions, indicated a disagreement between measurement techniques some of the time (Appendix 1). This is also unlike the Los Angeles experience where such parallel measurements are said to agree in both the laboratory and field within experimental error. Non-methane hydrocarbon-nitrogen oxides ratios are also different than other regions. The non-methane hydrocarbon mix of the atmosphere has never been characterized thoroughly over an extended time period. Background hydrocarbon levels differ. The Houston haze has been noted by citizens and scientists alike. It occurs frequently during the year and although it certainly has some components of a Gulf Coast sea haze the associated odors indicate a more complex mixture.

Technically speaking, there is a large area located from downtown Houston to Deer Park to the east, that is above the national primary ambient air quality standard (NPAAQS). As far as I can tell from the ambient air quality data this has been true since monitoring began in 1968 (Appendix 2). This area combines a lower economic, mixed ethnic residential area with all classes of industry. The Houston ship channel cuts through this non-attainment area. Currently the entire region is classified as non-attainment for oxidants (measured as ozone). Yet a reduction of more than 50 percent in hydrocarbon emission inventories has not favorably changed the frequency or concentration of ozone excursions above the NAAQS. The presence of the huge petrochemical industrial complex compounds the problem due to its complex organic emissions. However, the ozone levels have been seen to rise and fall simultaneously across huge areas of the state indicating this is a regional ozone problem as well as a point source emission problem.

The most unique feature of the current Houston atmosphere will soon come to an end. Ambient air measurements reveal a sulfate level of 10 to 15 $\mu g/m^3$ across the entire region with no man-made source of sulfur dioxide (SO_2) identifiable. In most regions sulfates are thought to be the result of conversion from SO_2 from coal fired power plants; thus the Houston area has benefited from SO_2 concentrations below the secondary ambient air quality standard while experiencing a sulfate level thought by some experts to be associated with ill-health effects to the population. The probability that SO_2 will be introduced into the Houston atmosphere in the future for the sake of new energy sources boggles the mind. The potential risk is vast for a population to suffer ill-health effects associated with a mixture of the known air pollutants and environmental stresses (small suspended aerosols, ozone, relative humidity, and temperature) with sulfur dioxide. The resultant mixture presents a potentially disastrous situation for asthmatics, cardiovascular patients and respiratory patients and older people in general.

Environmental degradation respects no man-made boundaries. And in Harris County, in the ship channel area, this fact is amplified as a problem in air pollution since there exists a political problem of overlapping or adjacent jurisdiction of air pollution control districts. Without the threat of federal intervention the local programs, in my opinion, would not have had the success they can claim in controlling emissions to the ambient air shed. The permit system for control of air borne emissions has been in effect since 1971 in Texas but only addresses the standard air pollutants. Hazardous pollutants of small concentrations are not reported. Only by special case ambient air analyses are they detected at all and little is done with such data. However, the technical capabilities of the state and local agencies are excellent and can easily be utilized with greater funding and federal guidelines.

EFFECTS

The impact of the environment on Houston's population has not been assessed. Local health studies have been short, incomplete, and inconclusive. Significant, positive correlations have been found between mortality rates and suspended particulate levels, mortality rates and temperature and humidity, lower than average lung function in older workers with heavy smoking experience and suspended particulate levels, and suggestions of significant correlations between ozone episodes and decreased lung function in asthmatic children. Yet to be explained are the higher than annual average population mortality rates for specific types of cancer, respiratory diseases, and cardiovascular classes. Environmental factors are known to contribute to these increased rates in other regions, but these factors have not been evaluated in terms of their health impact on the morbidity rates in Houston.

A central respiratory disease registry doesn't exist in Houston, Harris County, or Texas. The existence of such a registry would help enormously in the conduct of epidemiological morbidity studies that are needed to delineate the role air pollution may play in the community disease patterns.

Awareness of the citizens to the problems of a degraded environment can easily be seen by the growth of the affluent residential areas in the northwest. This area has more environmental amenities and less obvious pollution, air or water, than any other quadrant of the city. The flight of the middle class from the eastern portion of the city represents the negative aspect of this socio-economic problem. The resultant dislocation of people from job sites, increased highway burdens, and changing neighborhoods are just part of a kaleidoscope of socio-economic problems that have not been addressed but can be seen to already exist. Decreases in visibility are believed due, in part, to atmospheric aerosol growth due to air pollution. Clouds of haze can be seen developing in the petrochemical industrial area which then sweep across the city. The aerosol size is small so that nothing out of the ordinary is registered on the weight based suspended particulate standard measurements. It is often accompanied by noxious odors. Odor complaints are registered regularly with the Houston Pollution Control Division. This is the cloud of haze that scares most citizens. Its color, density, origin, and smell make this haze highly suspect as a determinate factor in the ill-health suffered by Houston residents.

The adverse impacts of a deteriorating environment are difficult to calculate or estimate with the current data base. Such benefit-cost analyses done elsewhere have produced gross estimates never validated. Area health plans produced by local HSAs may attempt such analyses in the future since they include environmental health as an integral part of any plan to decrease disease rates and thus the cost of ill-health care. Currently it is thought that prevention of disease due to environmental control is analogous to that which occurred with the reduction of infectious disease rates when environmental control measures were instituted.

STRATEGIES

From the above sections entitled "Description" and "Effects" it can be seen that little is known in depth about the Houston environment, including its atmospheric characteristics or about any environmental impact on the health of the community. Thus many questions are posed in this regard, the largest of which is what needs to be done. Currently control strategies are based on knowledge gained elsewhere. The few facts known about the Houston atmosphere indicate regional differences exist that may make that knowledge useless or even detrimental when used as a basis for control strategies on the Gulf Coast.

Thus we need research--research to characterize the environment, research to characterize the health status of the population, research to delineate the social costs of a polluted environment, research to anticipate regulatory needs and give them a strong regionally based criteria for action.

Research needs that both I, as a professional, and the San Jacinto Lung Association, as an organization, see to be necessary and sufficient follow. Each could be justified in depth but this seems to be the proper place for just an indication of our interests. These are not listed by priority, only classified into three groups.

Health Effects Studies

1. Health studies should include other stresses besides those of air pollutants. These should include socio-economic factors, ethnic considerations, occupational stresses, past history of disease for several generations, in vivo data on expected physical or pathological changes, and environmental factors which are known to have an effect on people at any reactant level from behavioral to mortality.

2. Study mortality data longitudinally, retrospectively at several levels of sophistication. Follow any plausible clues even further.

3. Conduct prospective epidemiological studies:

   a. Survey lung function of school children in different parts of the city simultaneously. Also in vivo parameters if possible.

   b. Evaluate and delineate areal distribution of disease related to or aggravated by air pollution. Areal correlations inter- and intra-city are needed in the same meteorological zone.

   c. Conduct panel studies with sensitives and biologically important personal monitoring. Dust and pollen badges, atmospheric acidity, respirable particles, and oxidation potential all should be considered.

4. Collect morbidity data from all existing sources: cancer registry, hospital admissions, clinics, etc., in order to determine what data are available or needed.

5. Develop new criteria for the role of specific environmental determinants and their impact on human health. These should include polynuclear aromatics, cadmium, radioactive isotopes, and other elements mentioned in the Clean Air Act Amendments of 1977. But they should be studied as part of human ecology in the context of the biosphere and not limited to their role as air pollutants. Thus total body dose should be assessed in each study delineating the role of pollutants in impacting human health.

Atmospheric Air Quality Characteristics

1. The natural background level of pollutants needs to be determined: specifically, THC, NMHC levels to the NW and SE of Houston on an annual basis. Terpenes and other classes of organics including polycyclics need to be evaluated and quantified as to the gross amount as needed in emission inventories.

2. Determine the chief constituents of the fine size respirable aerosols. Are the liquid aerosols organic, polycyclic, paraffins?

3. Determine the surface activity of the fine size respirable suspended particulates. Further, if they are active under what conditions--solar catalysis? What conversions take place? What adsorption-desorption takes place?

4. Determine the fraction of respirable suspended aerosols that is liquid. Identify possible sources--theoretical, secondary reaction products as well as known point source emission.

5. Determine the physical characteristics of the aerosols of interest, and how they affect total atmospheric properties.

6. Conduct an areawide survey to determine the most hazardous areas with regard to both liquid and solid suspended aerosol concentrations.

7. Investigate reported differences in oxidant/ozone measurement results.

8. What oxidant concentration exists other than ozone in the Houston area?

9. What are the chemical properties of the total ambient atmosphere?

10. Monitor unusual atmospheric characteristics vital to physiology during health studies: acidity, potential $\vec{E}$, +/- ion pair ratio, hygroscopic properties of aerosols.

Environmental Health Planning

Risk-benefit analyses should precede any proposed action. These guidelines should be followed:

1. In every environmental and health assessment, the risk or effects (biological and economic) of a given action should be weighed against the risk or effects of not taking action.

2. All risks or effects should be expressed in terms of changes that would be produced in our existing state.

3. In all estimates of risk or effects, there should be a clear statement of the uncertainties that pertain to the assessment to be used in decision making (proposed by C. Comar, Science 198(4317):567, 1977). With the data generated from the first two classifications and risk-benefit analyses included in environmental health planning at every decision-making level, a mis-use of newly generated criteria for environmental standard setting would be avoided.

Research is expensive and limitations exist in the number of qualified individuals required to work in a project of the magnitude indicated. So one of the first steps needed is the establishment of a research priority list. Conflict is bound to occur when expenditures are involved, so a mechanism should be established to see that the interested parties all have an input. I believe that an informed citizens' liaison group should be appointed to represent all the interests of the community being studied. These people, representing not only their community but factions within that community, each have a vested interest in the research outcome. This liaison committee should meet with the funding agency and major researchers (contractors or government scientists) and review the goals and objectives of each piece of proposed research. This committee could point out the need for specific research projects as perceived by the community, take part in the priority setting process, suggest mid-term project corrections through review procedures, and have as a court of last resort the new National Commission on Air Quality. The later group should be arbitrator since the EPA Administrator has ostensibly agreed to the position of his scientists by the time such difficulty would have arisen. Above all the group should be sanctioned by some political body.

Regional research is not a new concept. The uniqueness of the environment on a large scale has been recognized in the establishment of watersheds, regional planning districts, meteorological zones, and agricultural land use. Demography uses the concept in its organizational makeup. Economically much is being said about sun belt vs snow belt policies. So the idea of regional differences permeates the social, economic, and environmental sciences. It is not surprising that the need for regional research finally has surfaced.

The concept of national ambient air quality standards must be maintained and still allow for the concept of regional differences. Every community should have the right to the same amount of public health protection. With different mixes of environmental stressors in each region this does indeed present a complex problem, but it can't be solved by ignoring it. Total body burden of lead, for example, comes from an intake of air, water, and food with air accounting for less than 10 percent of the average intake. To adopt a control strategy that only regulates air intake is tantamount to expecting the tail to wag the dog. Criteria and control strategies development must be part of a federally orchestrated effort in which the differing agencies or divisions of agencies with environmental responsibilities must work in a concerted effort in order to achieve maximum meaningful and useful results. This represents the approach in terms of human ecology.

The mechanism for implementation of these results to yield NAAQS's which are fair to each region economically, socially, and protect human health to the same necessary degree is beyond the scope of our understanding. Thus we propose it as another research area.

SUMMARY

The San Jacinto Lung Association, a voluntary agency serving 12 counties, and I, personally, believe the impact of environmental stresses to be an important determinant on the health state of the local population. This is a regional situation with unique environmental components that cannot be assessed elsewhere. The potential for a local air pollution disaster due to forced coal conversion as an energy source, mandated under new legislation which now exists, desperately needed a risk-benefit analysis before such decisions were made and serves as an example of this need across the board. Research needs are paramount with input and liaison with local interests served by new liaison mechanisms. Determination of atmospheric characteristics, interaction with other environmental stresses, of the role the local environment plays in the health state of the community, are all necessary before environmental health planning and control strategies can be conceived. Risk-benefit analyses of contemplated actions should be undertaken before each action. We believe that using this human ecology approach to the problem of protecting the public from environmental stresses which produce ill-health will yield the most results for the least effort and still yield data effective for control strategies and ultimately reduce morbidity and mortality rates of environmentally influenced diseases.

APPENDIX 1: SELECTED REFERENCES

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APPENDIX 2: HOUSTON AREA SUSPENDED PARTICULATE LEVELS

Figure 1. Distribution of Suspended Particulates in Houston Annual Geometric Mean, 1976.

Figure 2. Distribution of Suspended Particulates in Houston Annual Geometric Mean, 1973.

Figure 3. Distribution of Suspended Particulates in Houston Annual Arithmetic Mean, 1969.

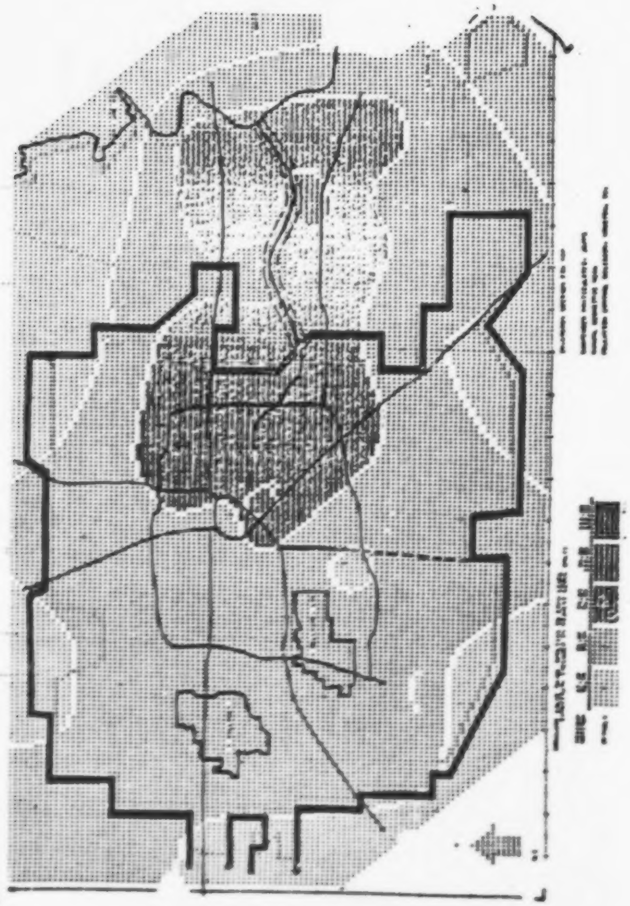
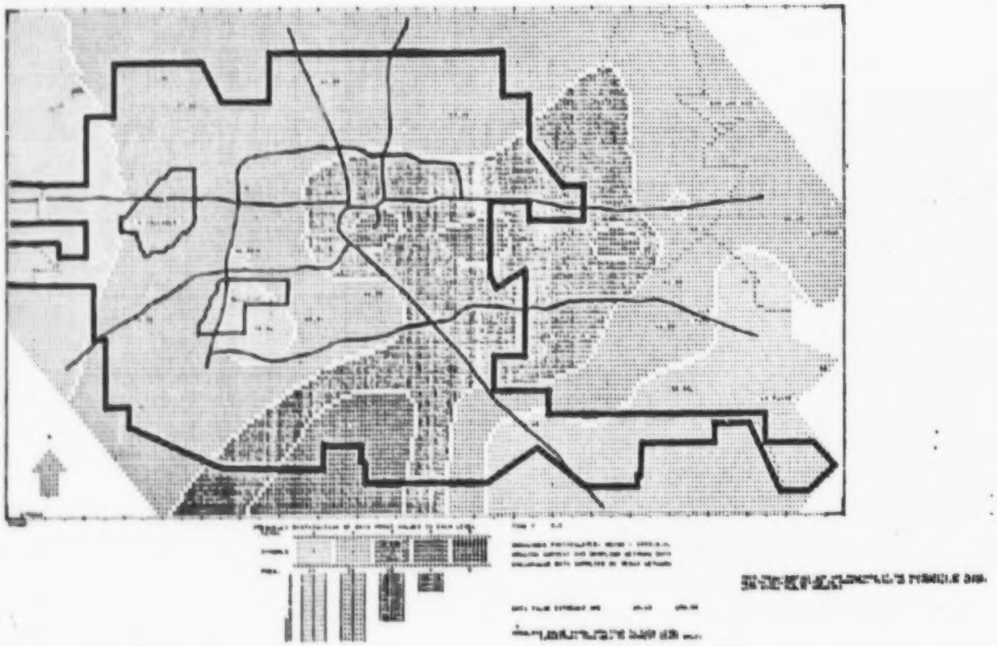


Figure 1: 1976

Figure 2: 1973



SUSPENDED PARTICULATE MATTER
Annual Geometric Mean

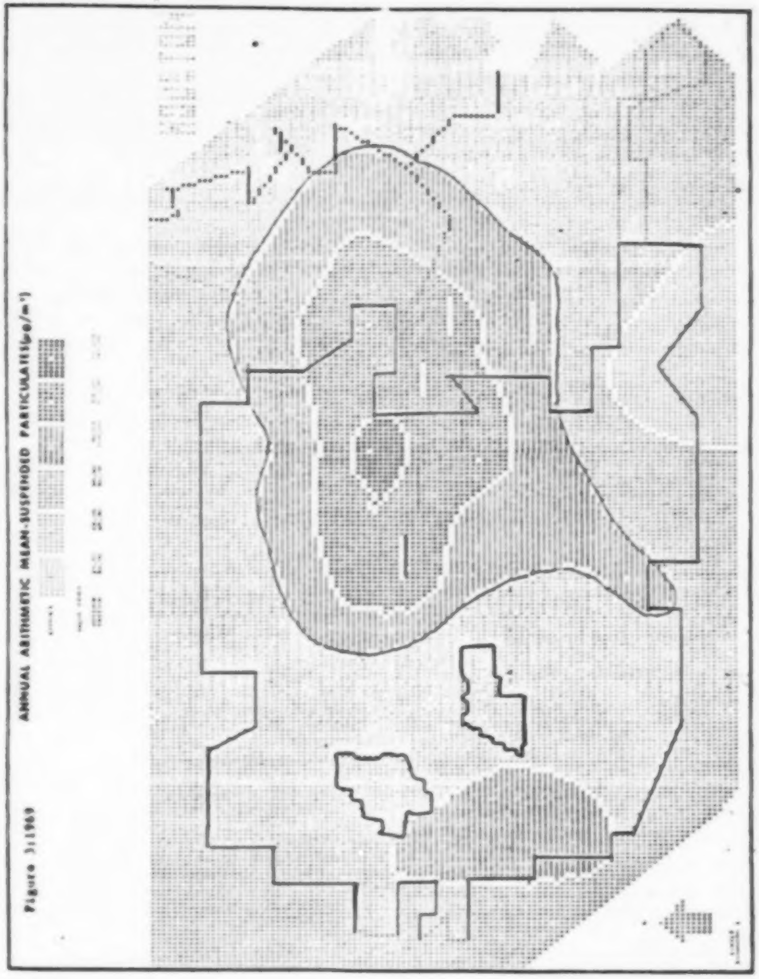


Figure 3: 1969 ANNUAL ARITHMETIC MEAN-SUSPENDED PARTICULATES (μg/m³)

Mr. Brown. Thank you very much, Dr. Severs. I think your stress on the kind of research that's needed here is extremely important. That emphasis is all too often neglected because of the way in which Congress has written the laws, for one thing, and sometimes because of the way the scientific process itself works, which tends to function on a small part of something rather than looking at the total effects. Mr. Wirth, do you have any questions?

Mr. Wirth. Yes. As our energy plans seem to project we move into the burning of coal, and as you suggest in your paper as well, we're going to end up with all kinds of new compounds, right?

Dr. Severs. Right.

Mr. Wirth. And that is what you're pointing out as a great, great concern down the line for Houston, correct?

Dr. Severs. My great concern is with the small particulate load, which will come out of the coal-fired power plants and the SO_2 addition to the air. In this environment we already have the humidity and in February, January, we have the same kind of meterological conditions that existed in London during their disasters. We haven't had the SO_2 and we haven't had the small aerosols, so we haven't had the problems. What I'm suggesting is that in the future, if we're not very, very careful and if we don't write standards for small particulates, by number rather than weight, we're going to have a problem.

Mr. Wirth. Now, a big piece contributing to this are the hydrocarbons, right?

Dr. Severs. The hydrocarbons present a different kind of problem to me. They're the lead—well, I don't know where they lead to. Presumably, we're looking at carcinogens. We may be looking at aggravators of other health effects. But in terms of the acute problem, no.

Mr. Wirth. The hydrocarbons are not—down the line, isn't there the potential of the hydrocarbons combining with the sulfates?

Dr. Severs. Certainly. But I don't know what the resultant action would be. I don't know what the result would be of that. It may indeed be a detrimental aspect, but I haven't done the research to say what this would be.

Mr. Wirth. I'm just trying to get at—it seems to me if we in Houston had not been removing a lot of these hydrocarbons now we'd potentially have or have the potential of even deeper problems down the line with the conversion of coal if we had up there not the reduction of 40 percent of whatever it has been but had a level of 100 percent and added all of the emissions from our coal conversion program that we would have accelerated rather than at least trying to hold a bit of a line.

Dr. Severs. Certainly there's a synergism in the environment that's going to cause more and more problems as we have more and more pollutants. And unlike some of the other previous speakers I believe we've done a very good thing to remove the amount of hydrocarbons from the atmosphere we have. If we are going to control the oxidant problem at all, eventually that had to come out. Now, we may also have to control oxides of nitrogen as well, and I'm sorry we haven't begun doing that. But I think that the action we've taken up to now has been a wise one. It was necessary; I think it's necessary to go further.

Mr. Wirth. I guess that's what I was trying to get at, that I've been a little bit surprised at the criticism of the strategy to try to remove as many hydrocarbons as have been removed, and it seems to me that all the evidence, at least that I have seen in my time in the Congress, is that that probably is going to be a positive contribution toward the maintenance of the public health.

Dr. Severs. I think it certainly will be in the future. I think what you've been hearing is the frustration of seeing this removed at an enormous cost without seeing any effects yet. Well, I view that as being necessary at this point, and we have to go further along with the oxides of nitrogen removal. When the two of them together have been accomplished, I think we may see some results.

Mr. Wirth. And that's when, hopefully, we'll get a new coalition that'll be able to go after all of the wonderful people in Detroit that bring us a lot of the oxides of nitrogen, right?

Dr. Severs. Well, I noticed in the new Clean Air Act Amendments that you certainly put a lot of emphasis on the study of oxides of nitrogen and their effects.

Mr. Wirth. Unfortunately, there was more emphasis on studying it than there was on removing it.

Dr. Severs. We have a little problem there.

Mr. Wirth. Thank you, Mr. Chairman.

Mr. Brown. Mr. Eckhardt?

Mr. Eckhardt. I have no questions.

Mr. Brown. Mr. Gammage?

Mr. Gammage. No questions.

Mr. Brown. May I ask you just one further question? Are you able to characterize the state of the technology with regard to the measurement of the small aerosols, the respirable particulates?

Dr. Severs. They're very expensive to measure—that's one of the problems. The equipment is available, but each individual instrument costs thousands of dollars. So it's been mainly a research effort, and control agencies have not, as a rule, measured the concentration of small particulates in the atmosphere.

Mr. Brown. This committee has been very much concerned about the general situation with regard to monitoring technology, and previous investigations of the subcommittee have indicated that it is deficient in a number of particulars and in this area the difficulties are particularly great.

Dr. Severs. Yes, they are. It is a very difficult problem. Particularly if you're looking at the total aerosol composition.

Mr. Brown. Well, we thank you very much for your contribution, Dr. Severs.

Dr. Severs. Thank you for the opportunity.

Mr. Brown. We understand that Senator Bentsen is here and in deference to his schedule we wanted to allow him to make a brief statement at this time. We would like to take him at this time, before going to our next witness this morning. Senator, we welcome you here this morning; your timing is absolutely perfect. We invite you to take the podium and give us the benefit of your statement. It's a pleasure having you. We welcome Senator Bentsen, who is very much concerned about this general problem of air pollution in the area, and whose suggestions as to the way to approach it, I'm sure, will be very helpful and valuable to the subcommittee. Senator Bentsen.

Mr. Bentsen. Mr. Chairman, I want to welcome you and the distinguished members of this committee, and congratulate you for interest you have shown in these environmental problems. Texans h always told you that they were unique, and in this instance we remain so. But unfortunately, under these conditions, we're not particularly proud of the problem. We have made great strides in Houston along the Gulf Coast area in cutting back on the emission of hydrocarbons, and yet we've seen smog increase. What appears to work for New York and California and other parts of the country just doesn't seem to work for us. So that's why I was delighted to join with Congressmen Eckhardt, Gammage, and with you, Mr. Chairman, in fighting on the other side—on the Senate side—to get through the Bentsen amendment, the $3 million in authorizations, and to help with the $1 million in appropriations. Several months ago, when the Senate was considering the Clean Air Act, I made the case before the Environment and Public Works Committee, of which I am a member, for trying to develop a study for the Gulf Coast area.

I did so because I had very serious concerns that the control strategies being used by the Environmental Protection Agency would not be effective in relating to the health and visibility problems we have in Houston and other gulf coast cities. This region has a combination of environmental and technological features which do not necessarily lend themselves to the control strategies being employed in other parts of the country. With our level terrain, a highly concentrated petrochemical complex, persistently high humidity and the added complication of salt from gulf coast air, it is my view, and the view of the Texas Air Quality Board, that it is wasteful and unwise to tie ourselves to an inflexible control strategy, without a thorough investigation of the features of the gulf coast region. In other words, we have to know what we're confronted with before we know how to apply our full energies to clean it up. Anyone who's been in Houston for a period of time knows that our air pollution is severe. I wish you could have been here last week, Mr. Chairman, to see what we are confronted with. And the monitoring data bears that out. When considering oxidants—thought to be the major component of photochemical smog—Houston's readings are typically three to four times the national standard, and among the Nation's worst.

Sure, Houston is a driving and a dynamic city—one of the fastest growing areas of the Nation. Just 17 years ago, in 1960, the population of the Houston metropolitan area was 1.4 million. Today it's approximately 2.5 million, and by 1985 we'll have another 800,000 people here. And in the midst of all of that growth, we're proud of our efforts to clean up both water and air. The Houston ship channel, not many years ago, was just a river of waste. It was one of the few bodies of water in the United States that deserved an octane rating. Now it's coming back. You see fish swimming upstream in the Houston ship channel. From 1971 to 1976 the Texas Air Board reported an 85 percent reduction in hydrocarbon emissions from stationary sources, a 60 percent, reduction from all stationary sources, and a 43 percent net reduction in all hydrocarbon emission sources. Yet despite these major efforts, we have been confounded in our effort to reduce overall oxidant levels. EPA has long insisted that these levels are to be determined by measuring ozone and by rigid control of hydrocarbons, and tied itself to a control strategy that's had little effect in grappling with the specific air pollution problems in the Houston area. There are many—and I include myself among them—who are not convinced that this strategy will ever succeed.

In Houston, data from the Texas Air Control Board indicates that even eliminating the hydrocarbon emissions from all automobiles—that is, if they all stopped out here at Eagle Lake or Arcola, on the city limits of this town and all the people walked to work—we would not meet the oxidant standards. Or on the other hand, if we closed down all the factories, told the workers there were no jobs left in Houston and sent them home, we again would not meet the oxidant standard. Yet that strategy remains inflexible, and the people of Houston continue to suffer. We believe there must be better ways to meet this problem. In the first place, we want to see a thorough examination of the sources of Houston's pollution—and that includes not just a measurement of ozone, which is an inexact and a controversial process, but also a look at the aerosols, at the sources of the small particles found in Houston's air. We want to know about those particles which affect visibility, and those which affect health. And we want to know if there are possible ways to reduce the incidence of both. And also, at some point during the final stages of the study, we want to know whether the total EPA policy for oxidant control should apply along the gulf coast, or whether we would do well to explore new, more innovative methods. Now, that's a tall order for such a study, but I'm convinced that the people of this region, in cooperation with EPA, can arrive at the proper answers.

That brings me to my final point: the structure of the study itself. For the people of Houston to have confidence that this will be a careful review of Houston's air problems, it's crucial for EPA to work actively with the groups in this region who are qualified to assist, and who have a deep concern and a substantial knowledge about the problem. A liaison committee has been established, headed by Dr. Stanley Pier, of the University of Texas School of Public Health, to work with EPA on the study. Dr. Pier's committee consists of representatives of the Harris County Medical Society, the San Jacinto Lung Association, the Houston Health Department, the Houston Area Oxidant Study, the Texas Air Control Board, and others. It's a responsible group, created not to compete with EPA but to cooperate with it. Much of the success of this endeavor will depend on the working relationship that's established between this committee and the EPA officials, and I want to strongly urge that a spirit of cooperation be established early and maintained through the course of this study. This is not and should not develop into an adversary relationship. I am confident that this process will succeed. It has a broad level of support at the local level and a substantial promise of assistance from the Federal Government. It is a timely study, coming shortly after the passage of the comprehensive Clean Air Act Amendments. Further, it directs air pollution research funds to an area of the country that has long been shortchanged in the distribution of these funds.

Once again, Mr. Chairman, I'm delighted to be with you. I appreciate your real concern for the problems of this gulf coast area and am pleased to see my distinguished colleagues, Congressman Gammage and Congressman Eckhardt, join with you in this effort.

Mr. Brown. I want to thank you very much, Senator, for your contribution. There's nothing that helps to establish the fact of the high priority which the citizens of Texas attribute to this problem than to have you here this morning and to have you make the kind of statement that you've made. I know that much of the research on atmospheric air pollution has historically stemmed from the problems of the Southern California Air Basin. I don't like to see the competition between California and Texas extended to that kind of problem, but I am personally convinced that by using the example of the Houston area, together with the resources of the Houston area, we can make a contribution to the solution not only of Houston's problems but California and the nation's problems. And I would like to see that kind of cooperation between your citizens in this area and the EPA and others concerned with the problem.

Mr. BENTSEN. Mr. Chairman, let me say, when much of the Washington press is commenting today about Congressmen junketing around the country, and around the world, I'm delighted to see this delegation down here, seriously at work, concerned about a major problem of the Nation, and dedicating their efforts to try to work toward its solution.

Mr. BROWN. Thank you very much. Does any member of the committee have any questions they'd like to ask the Senator?

Mr. WIRTH. I just had a comment, if I might, Mr. Chairman. I really appreciate being here from the perspective of Denver. We're at a population figure now where you were in 1960, and growing at that same kind of a rate. We have our own unique kind of air pollution problems in Denver, where Chairman Brown happily brought the subcommittee last week. We were examining Denver's problems, so we've got to stick together on this. I appreciate your being here, Senator.

Mr. BROWN. Thank you very much. Senator, we appreciate it. Our next witness this morning will be Mr. Ray Lozano, who is director of the Air and Hazardous Materials Division of EPA, and we're very pleased to have Mr. Lozano here. It seems to me there's been a remarkable demonstration of unanimity of viewpoint on the importance of this problem, which I'm sure Mr. Lozano shares, and it may be that we're further along toward achieving a structure of organization to meet this need than we had thought. You may proceed, Mr. Lozano, and the full text of your statement will be made a part of the record at this point, if you feel a desire or need to summarize any portion of it.

Mr. LOZANO. Thank you very much, Mr. Chairman, members of the committee. It's going to be a tough act to follow. Senator Bentsen speaks so eloquently.

Thank you for the opportunity to testify at this hearing. Before I present my statement I would like to introduce a few fellows that are in the audience that represent our headquarters office of EPA and also some representatives from Research Triangle Park. Dr. Basil Dimitriades is in the second row, from Research Triangle Park Environmental Sciences Research Laboratory, and Dr. Carl Hayes of our Office of Health Effects at RTP and Mr. Stan Blacker, who's in the rear, from our Office of Research and Development in Washington.

Mr. BROWN. We're very pleased to see these gentlemen here this morning. I'm sure it will contribute to the effectiveness of communicating the input from the hearing to have them here listening to the proceedings.

Mr. LOZANO. That's exactly why I invited them.

[The prepared statement of Mr. Lozano follows:]

STATEMENT OF MR. ELOY R. LOZANO, DIRECTOR, AIR AND HAZARDOUS MATERIALS DIVISION, ENVIRONMENTAL PROTECTION AGENCY, REGION VI

CURRENT AIR QUALITY PROBLEMS IN HOUSTON

Houston has for many years had air pollution problems which include haze, high levels of photochemical oxidants and particulates, and odors. These problems are not unique to Houston, but are typical of several industrialized Gulf Coast areas including Corpus Christi, Beaumont/Port Arthur, and parts of Louisiana, in this region. The problems in Houston are most pronounced due to the greatest concentration of industry and people along the Gulf Coast. These problems originate primarily with emissions from the high concentration of petroleum and petrochemical industry in the area and to a lesser degree with automobiles. In addition, the warm humid climate is another contributing factor, we believe particularly that of haze.

Through local, State and EPA efforts, there has been significant abatement of emissions in the Houston area. Abatement efforts have thus far been directed to hydrocarbons (to control oxidants) and particulates, since these are the established air quality standards which are being exceeded in Houston.

However, due to growth in the area, more and better air quality data, and for other yet unidentifiable reasons, air quality does not appear to be greatly improved. I say "appear" since it is questionable whether or not there is enough data taken over a sufficiently long time period to really establish a trend. At any rate there are still frequent violations of the oxidant standard (up to two to three times the standard) and the haze continues to persist. For the record I am including with my statement copies of the EPA document EPA 906/9-76-001 "Technical Support Document, Hydrocarbon/Photochemical Oxidant Control Strategy for the State of Texas" and a copy of the July 21, 1977 EPA regulations promulgated for Houston and other Texas cities which describe the Texas oxidant/hydrocarbon problem and the control measures pursued thus far by EPA. These measures included extension of existing TACB Regulation V, control of evaporative losses from the filling of gasoline storage vessels in the Houston, San Antonio, and Dallas/Ft. Worth areas, the control of evaporative losses from storage vessels for crude petroleum in certain counties, an incentive program to reduce vehicle emissions through increased bus and carpool use, an employer mass transit and carpool incentive program, and a transportation mode trends monitoring regulation.

We believe all of these regulations that have been promulgated for the Houston area to be reasonable and will contribute to reduction of the oxidant problem.

As recognized by the 1977 amendments the standards have not been attained and additional measures will be required. In the case of photochemical oxidants the standard of 0.08 ppm may well not be attainable in Houston, but, even if this is the case, additional controls are needed to keep the situation from getting any worse and to reduce the severity and frequency of violations.

We still maintain that hydrocarbon reduction will eventually lead to the reduction of oxidants. There's just an overwhelming amount of evidence that the two are definitely related—maybe not on a one-to-one basis, such that we can see immediate improvements—but we still maintain that the oxidant problem is here and it will be controlled through hydrocarbon controls.

RESEARCH EFFORTS

While much air pollution health effects research work has been conducted in other parts of the Nation, admittedly little has been specifically accomplished by EPA in the Houston area. The Houston Area Oxidant Study is developing additional information and we are very much interested in that effort and have kept abreast of their efforts in order to coordinate our ongoing research activities.

We do have information and are gathering more on the health effects of oxidants and the more we look, the more the 0.08 ppm health standard is substatiated. I believe that a recent draft summary statement from the advisory pane on health effects of photochemical oxidants summarizes the status on oxidant health effects as well as any document I've seen and I'd like to read a summary paragraph from that document as follows:

"In reviewing the body of evidence on health effects, the health panel concluded that there is no compelling reason to suggest a change from the concentration defined by the existing primary air quality standard, namely 0.08 ppm. This conclusion was based upon the previously cited panel consensus that a variety of adverse effects are likely to occur in some segments of the population from short-term ozone exposures of 0.15 to 0.25 ppm, and upon other evidence that suggests, though less conclusively, the possibility of effects at concentrations as low as 0.10 ppm. The Panel recognized that this standard provides very little margin of safety, for the reasons cited immediately above."

I am including a copy of the entire document with my statement, since this subject is of great interest in the Houston area. Of course, the air quality standard for photochemical oxidants is still being reviewed, as required, by the Administrator of the EPA, and a decision on whether to revise the standard will be made at a later time.

Another area of concern is the health effect of aerosols and fine particulates. There have been some EPA studies conducted, but much more is needed as pointed out by the Texas Air Coutrol Board and others here today and as recognized by the requirements of Section 403(d) of the 1977 Clean Air Act Amendments. At present there is $1,000,000 of EPA Research and Development money for FY 78 allocated for the Gulf Coast Study. This amount may be expanded to as much as $3 million, and it is my understanding that this may come about soon through the appropriations from Congress. A technical liaison committee has been formed and is made up of a cross-section of representatives from the Houston area, the Texas Air Control Board, and myself as an ex officio member. We met on October 19, 1977 to discuss air pollution research needs for the Houston area and I have included with my statement a copy of the minutes of that meeting, which I moderated. There was a concensus of the committee that EPA's initial research efforts should be directed at:

1. Determining the impact of aerosols (fine particulates) on health effects;
2. Defining the sources of these aerosols, and to what extent these are natural or anthropogenic, or primary or secondary sources;
3. Developing improved techniques to collect/measure aerosols; and that the first health effects undertaking should be to;
4. Develop a health effects surveillance system for the area. This system should be aimed at defining the extent of the air pollutant related health effects and what are the appropriate health indicators (associated with air pollution) of these effects.

Another thing that came out at that meeting, and I didn't include it with my statement and I should have—it's in the minutes of the meeting—was that the Citizens Clean Air Coalition seemed to think that the EPA was not doing enough in the chronic effects of air pollution area, and I think that that was an important statement. Our reply at the time of the meeting was that there's certainly a need to look into that area but it's quite costly to look at chronic effects and on the short-term perhaps not the best way to go.

To me, one of the most significant items to result from these discussions was the consensus that prior to initiating any air pollution research studies, in Houston that EPA should develop an overall research plan for the Houston area. It is my understanding that our office of Research and Development is well on its way to accomplishing this prior to initiating any of the other proposed studies for the area.

I can assure you that EPA is listening to the comments that were made that day and to the comments of the committee that was formed. County Judge Lindsay asked for an official, some sort of official sanction and I personally intend to look into this possibility either with our people from Washington or perhaps with the regional office, but I intend to investigate it in some way.

As this research effort proceeds, other specific projects will be identified, but I think this is a good start.

This concludes my remarks. Thank you.

Mr. Brown. Thank you very much, Mr. Lozano, for your excellent statement and the additional materials which you have submitted.

There's a very strong theme underlying the testimony we've had here this morning—the importance and need for some local input to the structuring and conduct of any research activities that take place here and the Gulf Coast Air Pollution Research Committee has been suggested as a mechanism for doing that. Do you think that you personally or the EPA has any problem with this idea of having an adequate local advisory input to research programs addressing a local problem?

Mr. Lozano. None whatsoever. I think that we encourage it, and I personally was very pleased that the committee had the makeup that it did and that it kind of represents a cross section of the entire Houston community—we have representatives there from industry, from the community, from the citizens' groups, the regulatory agencies, the health association—I think that we're very much encouraged by that and will listen to them very intently in the development of any research plans that we have for our area.

Mr. Brown. Now, with regard to the overall adequacy of EPA's research program in the Houston area—and I'm not in any way trying to imply criticism, because I am as aware as almost anyone of the constraints that exist on all of EPA's programs—do you feel that there has been a substantial amount of EPA research directed at those aspects of the local problems that are distinctive or unique? Is there any component of the research that would characterize those features of Houston's problem?

Mr. Lozano. I think that the major emphasis of our agency in its research efforts has been towards studying the health effects or the transport—other air pollution related type of activities—concerned with the national air quality standards. Those pollutants that have been thought to be nationwide problems and that were first identified by the agency as a result of the original Clean Air Act, the Clean Air Act of 1970. Most of the effort that has been done across the country has been aimed at those particular pollutants. That's not to say that there haven't been some projects—a few projects—that were aimed at other things, such as carcinogens and diesel exhaust and things like this that were not really aimed specifically at the air quality standards or the criteria pollutants, but that has been the emphasis. Here in the Houston area, there very well may be some additional compounds in the air that we have not looked at—that we're not aware of, and maybe that's the area that we should concentrate on in the near future. These are the things that we need to look at. The relationship between hydrocarbons and oxidants is a controversial one; it's been around for some time, and we've been studying that aspect, some here in the Houston area, some in other parts of the country. But these other pollutants—the more exotic pollutants, if you might call them this—have not been looked at much in Houston, and I think that perhaps they should be.

Mr. Brown. What about some of the nonexotic pollutants like the potential for a 2,400 percent increase in SO_2 over the next, say, 15 or 20 years as a result of combustion of coal and lignite. Is there any prospective analysis been made on this kind of a situation?

Mr. Lozano. I'm aware that some studies have been conducted, on paper, by our energy office, of the projections on the amount of sulfur emissions, the increased amounts that will occur in areas like Houston.

As to what impacts these might have on air quality, I'm not aware any studies that have been conducted, but there very well may be son.

Mr. **Brown**. There are some general problems in this environmental area that in my opinion are still not adequately addressed, and it probably will be years before they are. Both of the things that I have in mind have been brought up here this morning. One is the adequacy of a comprehensive monitoring program—are we actually anywhere close to having a monitoring system and technology adequate to characterize the environmental pollutants in the area? Second—and it stems in part from the first—is there any systematic effort to relate monitoring data to health effects? If you don't have good monitoring data, you can't have good health effects data, to begin with. What is the situation as far as that's concerned in this area?

Mr. **Lozano**. With respect to the development of a comprehensive monitoring system, this State is very fortunate in having what I would describe one of the best monitoring systems in the country. Unfortunately, that is not true in other parts of even our EPA region and certainly not in other parts of the country. EPA, in the development of regulations concerning monitoring, tried to develop a minimum sampling network to describe, again, the criteria pollutants. That's been the big emphasis of our agency all along. And I think that there probably is a minimum network operating across the country now—it should be much better than that. A year ago, the agency realized that we weren't doing enough in this area, that some of these pollutants were getting bias, there were some areas of the Nation that were not being covered, and there was a system developed between the States and EPA to improve that situation. It was a working group of individuals developed who came up with what I think is a very practical and very comprehensive monitoring plan for the country. And this is now being implemented. It calls for, in some cases, reduction of monitoring in some areas, because where it's well saturated with monitors it may be that it's necessary to cut back. But I think that as a result of this—at least for the criteria pollutants—we're going to have a much better data base. And for the more exotic things, I think that areas that need these measurements will be getting them.

Mr. **Brown**. We'll stipulate for the criteria pollutants that we have an adequate network. What about the situation with regard to the development of adequate monitoring for the small aerosols and respirable particulates?

Mr. **Lozano**. No, sir. I'm afraid we just don't have a network that will get that kind of a measurement for us across the country, certainly. Maybe in certain parts of the country we might be able to have information available on these pollutants because of some specialized study that was conducted there. But nothing comprehensive, nothing routine that I would say really would describe the overall problem.

Mr. **Brown**. And if that is a unique aspect of the Houston pollution, then we're just not prepared to adequately monitor it, then, are we?

Mr. **Lozano**. Well, the techniques are there. The instrumentation—the methods of collection for aerosol—may not be 100 percent proven but the techniques are there and I think, particularly on a research basis, they could be implemented to get a much better data base in the Houston area.

Mr. **Brown**. Mr. Wirth, do you have any questions? Mr. Eckhardt?

Mr. ECKHARDT. Mr. Lozano, there are six pollutants that you use with respect to your ambient air quality requirements—particulates, photochemical oxidants, sulfur dioxide, carbon monoxide, oxides of nitrogen, and nonmethane hydrocarbons; is that right?

Mr. LOZANO. Yes, sir.

Mr. ECKHARDT. And those are the only things that you actually set ambient air standards on, as such.

Mr. LOZANO. That's correct.

Mr. ECKHARDT. But you consider hydrocarbons as a precursor to photochemical oxidants, and therefore you require a reduction of hydrocarbons in the air in this and other areas in order to accomplish that objective, right?

Mr. LOZANO. Yes, sir.

Mr. ECKHARDT. And under the existing amended Act of 1977, these must be reduced to the allowable level in the case of all but photochemical oxidants at least by 1981. And in the case of photochemical oxidants, by 1986, right?

Mr. LOZANO. I think it's 1982 and 1987. An extension may be granted for the automotive pollutants, for the carbon monoxide and the oxidants, to 1987.

Mr. ECKHARDT. I know I'm perhaps oversimplifying it, but you require that there be steps toward the ultimate objective in increments which may be found acceptable to the EPA during that period of time. Now during that period of time, do you set certain goals or requirements with respect to hydrocarbons, say, in this area, or reduction of hydrocarbon levels in order to achieve the reduction of photochemical oxidants?

Mr. LOZANO. Yes, sir. I think that the way the act reads is that in the case of the hydrocarbons, if it cannot be demonstrated that the attainment will occur by 1982 through implementation of reasonably available control technology and that further more stringent measures are required to achieve that standard, then these can be, the legislative process can be, accomplished by 1982. I'm thinking specifically of such things as inspection/maintenance of automobiles, which right now will require, in most areas, some more legislative changes to accomplish. And these can be specified by 1982, but attainment need not be demonstrated until 1987.

Mr. ECKHARDT. But there's not anything in the Act concerning hydrocarbons. That's something that is considered by the agency as a precursor and therefore standards are established with respect to hydrocarbons looking toward reducing photochemical oxidants, isn't that true? Except, of course, the methane hydrocarbons?

Mr. LOZANO. These methods to achieve the standards are called hydrocarbon control measures.

Mr. ECKHARDT. Well, isn't that your agency's program, not the language of the statute?

Mr. LOZANO. Hmm. I believe the term "hydrocarbon control" is in there.

Mr. ECKHARDT. Well, let me ask you this. If—suppose you found that certain oxides of nitrogen were one of the causes. Could you not require a reduction of the oxides of nitrogen to a greater extent and the reduction of hydrocarbons to a lesser extent within the authority of your agency?

Mr. LOZANO. Yes, sir, we could.

Mr. ECKHARDT. Have you decided that the continued reduction of hydrocarbons, looking toward the reduction of photochemical oxidants, will be the sole means of achieving the goals with respect to photochemical oxidants?

Mr. LOZANO. The research that we have conducted in this area leads us to believe that the the primary emphasis of control toward attaining the oxidant standard is hydrocarbon control. It very well may be that there may be some studies developed which would lead us to change our minds in this area—I don't really know. But I don't think that is the case for the time being. I have seen no change in emphasis on the part of our agency of going to any other type of control other than hydrocarbon control.

Mr. ECKHARDT. Well, we've heard statements here, and I have also read statements of various persons who have studied the question, that the hydrocarbon level has been decreased in this area by a net of approximately 40 percent and yet there has not been a substantial reduction of oxidants in the area.

Mr. LOZANO. I do not have an answer for that.

Mr. ECKHARDT. Is that correct?

Mr. LOZANO. That's true. There has been an overall reduction of hydroerabons that can be calculated on paper and I believe personally that there are other factors involved—perhaps the oxides of nitrogen; I'm not discounting that—but I wonder if indeed the amount of hydrocarbon reduction that is being shown by our agency and others is actually occurring? I'm thinking that perhaps the amount of hydrocarbon reduction that we can calculate from automobiles, because of the new autos coming on line, is actually being achieved. Once that automobile gets out on the road I don't doubt that the emissions standards are being met as it rolls off the assembly line, but I'm wondering if, indeed, these same levels are being maintained for the first 1, 2, 3, or 4 years and through the life of that automobile. I know that our——

Mr. ECKHARDT. Suppose hydrocarbon pollution in this area has been reduced by 40 percent. What would you anticipate as the required percentage reduction within the near future—do you have any views on that?

Mr. LOZANO. Well, the levels that are required for the Houston area are something like 60 percent, 65 percent, as I recall. To achieve the standard.

Mr. ECKHARDT. Sixty-five percent below that which existed at what time? Before the 40-percent reduction was calculated, or further reduction?

Mr. LOZANO. Before the 40-percent calculation was made. We needed a 65-percent reduction to achieve the standard.

Mr. ECKHARDT. And if the 40-percent did not seem to move in the direction of achieving the standard, why do you anticipate that the further reduction of 25-percent more would improve the situation?

Mr. LOZANO. I don't have an answer for that, Congressman. I admit that these are unidentifiable reasons. What I question is whether there has been the reduction. Because in other parts of the country—and maybe Houston is singular, I don't know, I don't want to argue that—but in other parts of the country where hydrocarbon reductions have been achieved over a long period of time, and we have an adequate data base to see what the oxidant levels have done over a long period of time, these reductions have been demonstrated.

Mr. Eckhardt. Well how long would it be permissible to continue with industrial growth in this area, without reducing the hydrocarbon level by a 65 percent, or an additional 25 percent? Or would you simply put the lid on now? I assume there would be some time lapse, because under the statute a considerable period of time is allowed to meet the oxidant levels. But what would be the immediate goal—say within a year or two—that would necessarily be met in order to continue to build plants. As I understand that act, if they are new plants, they must be built with the highest attainable level of pollution control.

Mr. Lozano. That's an excellent question, Congressman. I foresee the time, it seems to me, that even under the offset policy as it presently exists, that we continue to make up the amount of hydrocarbon increases through reductions elsewhere, and if we continue to see no improvement whatsoever I just don't know what we're going to do. Certainly I would hope that his research effort would help us in that area.

Mr. Eckhardt. We don't know what the oxidant level was before industry developed in this area and automobiles began to boom—there's no way we can look back, because we didn't have the techniques then. So we don't know whether oxidant levels have greatly increased except from our common experience. I think that as one who has lived here a good while I can say that that which is visibly obvious as a result of photochemical oxidants indicates that they have increased. But we don't know precisely what caused the increase.

Would it be conceivable at your agency, having a period of time granted under the statute for compliance in this area, might relax the movement toward reduction of hydrocarbons pending some specific study in this area that might implicate some other cause? Of course, if no other cause can be found, you might have to go back to your hydrocarbon theory, but it would seem to me—listening to Senator Bentsen's testimony, it seemed to me that he considered your program rather rigidly attached to hydrocarbons. I don't know whether that's a fair judgment of your program or not—perhaps you'd comment on that or perhaps comment as to whether or not there could be a degree of flexibility, at least during a period of time when the specific problems of the area are being studied.

Mr. Lozano. We have been very rigid in the development of hydrocarbon control strategies, and, as I see it, we will continue to do so in the immediate future. Whether there could be a moratorium there while something else is studied, I don't think I could answer that.

Mr. Eckhardt. I'm not exactly asking for a moratorium, but perhaps a standard of reduction that doesn't call for what may be an economically impossible result. Now, I want to tell you right off that I agree with you in insisting on a program by the Texas Air Control Board which is acceptable by EPA before you move to that instead of simply applying your present offset policy. And I'm not asking you to do other than to set some kind of reasonable requirement for such an alternate program before you move that way. But it does seem to me that, from your statements and from the facts we've had here, [illegible]t you may be a little too rigid with respect to assuming that the r[illegible]tion of hydrocarbons will move us in the direction of meeting the standards with respect to photochemical oxidants. It would seem to me that there may be some quite valid argument—at least, most of the persons who have testified here indicate that there might be a valid argument—that other pollutants may be the factors. Even your own statement opens that possibility. I understand that in a hearing you can't make a statement of policy that your agency is going to follow in the future. I'm just suggesting that all the testimony here seems to indicate to me that, at least for a period of time, increments that would achieve the 65-percent reduction may be too great to be feasible under the circumstances, and if imposed now might be irrationally rigid.

Mr. LOZANO. I think that the strategies that have been developed, the control measures that have been imposed, represent our best estimate of what "reasonable" is, and even though in some cases they are costly, they are measures that have been used in other parts of the country, without a severe impact to my knowledge on any community or on any industry. We will continue to use them in the future, realizing full well that we want to get to the standards as quickly as we can—that's our mandate. Some of these things that we're talking about as hydrocarbon controls are indeed the ones that have been discussed as more stringent measures, for example, the offset and controls on ship and barge, things that obviously have a high cost factor—we've delayed. We've held back on these because we do want to try and maintain reason, and I think over the period between now and 1982 we look for the 1979 plan to be submitted by the States to contain reasonable measures. Not because we're so uncertain that hydrocarbons, reduction of hydrocarbons will eventually get us there, but because of the fact that some of these things are brand new to us, some of these techniques are brand new in the area of controls, and we're trying to go slow with them. But I think the agency is firm in its position that hydrocarbons are the principal culprit here.

Now, there may be other things that will come along in other studies—perhaps even oxides of nitrogen, even though our agency has not accepted that the control of that particular pollutant is a way to go in urbanized areas—but it could, indeed, as new studies are performed, we could be altering our position. But that's where it is right now. There's too much evidence to indicate—in the laboratory and other places—that this is the way to control oxidants. And for that reason, we're sticking to it.

Mr. ECKHARDT. I compliment you for your firmness, but perhaps not for your rigidity.

Mr. BROWN. Thank you, Mr. Lozano. I'm sure that we would like to have you spend some more time with us, but we have several more witnesses this morning, and we'll have to defer the pleasure of interrogating you further.

Our next witness will be Mr. A. D. Cyphers, president of the Texas Chemical Council. We welcome him here this morning. You may proceed with your statement, Mr. Cyphers.

[The prepared statement of Mr. Cyphers follows:]

STATEMENT BY THE TEXAS CHEMICAL COUNCIL TO THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE IN HOUSTON, TEX., ON NOVEMBER 21, 1977

Good morning. I am A. D. Cyphers, and I represent the Texas Chemical Council (TCC). The Texas Chemical Council is an association of 73 chemical companies. We have over 60,000 employees and represent approximately 90 percent of the installed capacity of that industry in the State of Texas. Essentially all of it is along the Gulf Coast, and we're proud that we produce over half of the country's petrochemicals. The council tries to contribute constructively to policy and rulemaking activities whenever we can, and we certainly appreciate this opportunity to comment.

Let me start by posing what we see as the two basic questions about Gulf Coast air pollution. We perceive these two problems:

First, what causes the haze and reduced visibility which occurs in the Houston area? Does this haze cause adverse health effects?

Second, is the photochemical oxidant standard, developed largely from Los Angeles health data, applicable to the Gulf Coast area? Are the local oxidant concentrations harmful to health?

Let me address briefly the status of our knowledge about each of these questions.

Haze, aerosols and fine particulates are subjects that have proven to be difficult to study. For example, we do not know the sources, the components, nor the prerequisite condition for formation of the typical Houston haze. We do not know the conditions that cause it to be stable after it has formed. And we do not know the effects of atmospheric conditions on it, beyond a general observation from a Texas Air Control Board study that haze is aggravated by high humidity.

We have no data on either the short or long range health effects, if any, except that the Houston haze does not have the eye watering or respiratory effects that were noted in Los Angeles. Thus, all areas associated with haze problems need research and additional information.

In contrast, a considerable body of oxidant data have been gathered since the EPA standard was imposed late in 1970. From these data it can readily be concluded that the standard as presently defined, 0.08 PPM, 1-hour average, not to be exceeded more than once per year, will never be met in a great many areas of the United States, both heavily, and lightly populated places.

For example, in the Houston area ,which typifies the Gulf Coast region, hydrocarbon emissions were reduced by 40 percent between 1973 and 1975 and yet there was no decrease in oxidant levels for the same period. Many rural areas will never meet it. The EPA, the Texas Air Control Board, and private industry have measured ozone values above the standard in rural air over 100 miles from any large population center and also in air that was blown in from the Gulf of Mexico. This situation results from both natural and manmade causes, and the economic and social disruptions required to attain even a close approach are totally unacceptable. These views are not only ours but represent the consensus of most technical experts in air pollution.

Additionally, there are serious and valid technical questions regarding the analytical basis for the .08 ppm standard. The Los Angeles health effect correlations also draw severe criticism as to their applicability to the gulf coast area.

Because of the many uncertainties about the oxidant standard the council and many of its member companies have been active supporters of the Houston area oxidant study whose activities are described in the following Chamber of Commerce statement. This study, which represents to me a most remarkable coalition of public and private interests, is the forerunner of the kind of research needed in this area with a program that was well planned, broad in scope, and extends over a time period.

Having posed the question of what we think the gulf coast pollution problems are and the status of each, let me now turn to our recommendations. We believe the following areas need investigation:

First, epidemiological and clinical studies of the health effects of Houston area haze and oxidants,

Second, the collection and detailed characterization of fine particulates and aerosols. This study should include airborne as well as ground level sampling and should be carried out over an extended time period,

Third, expanded meteorological data collection and analyses, and

Finally, environmental chamber studies to evaluate the potential of particular Houston area air for haze and smog formation.

As to how these are to be accomplished we heartily endorse the recomme tions of your conference report (No. 95–722). We are greatly pleased to see the conference committee anticipated that the needed studies would require a coordinated research program continuing for several years. We are also gratified that it anticipated making considerable use of local facilities and personnel. We believe such participation is essential to avoid overlooking important local conditions that might affect the validity of the study and to coordinate with past and ongoing efforts. We believe that the state of our present knowledge is so meager that all available monies should be spent on technical and scientific studies.

We commend that HAOS approach to you. We recommend a local steering committee, with a technical subcommittee, be formed to help identify specific programs, priorities and provide direction. The Texas Chemical Council offers to make available for such an approach the technical expertise that we have in our industry.

These studies are aimed at the gulf coast and Houston is the essence of a gulf coast urban area. We think regional studies should be done here as Houston is uniquely suited for this, with its collection of universities and colleges, medical and health schools, and private and Government research centers. Additionally, Houston has an already extensive air pollution monitoring network operated by the city's health department and the Texas Air Control Board. The industrial community also operates a number of meteorological stations and air pollution monitors.

We believe that such studies can make a vital and much needed contribution to solving our common problem of how to have clean air.

Thank you very much.

A. D. CYPHERS, JR.

A. D. Cyphers, Jr., is the manager of the du Pont plant at Victoria, Tex., and currently the president of the Texas Chemical Council (TCC).

Mr. Cyphers, who was born in Yukon, W. Va., started working for du Pont in 1948 after receiving his B.S. and M.S. degrees in chemical engineering from Virginia Polytechnic Institute and after serving for 2 years in the U.S. Navy in the Pacific Theater. He is a registered professional engineer in the State of Texas, a member of the American Institute of Chemical Engineers, and many other civic organizations.

TEXAS CHEMICAL COUNCIL PRESENTATION AT TEXAS AIR CONTROL BOARD HEARING

MAY 28, 1975, HOUSTON

"ADDITIONAL HYDROCARBON CONTROLS"

My name is R. G. Dillard. I am manager of Shell's Deer Park Manufacturing Complex and Chairman of the Texas Chemical Council's Air Conservation Committee. It is in the latter position that I appear at this hearing today.

The Texas Chemical Council has 63 member companies engaged in the manufacture of plastics, synthetic rubber, metals, petro-chemicals, and a myriad of inorganic and organic chemicals that are an essential part of our present economy and basic to our standard of living. Collectively, the TCC member companies directly employ more than 49,000 people in Texas. Indirectly, untold numbers of Texans are employed in supplying our industry, using our products, and constructing our plants.

The TCC is deeply concerned with the subject of this hearing. We are concerned not only by the direct subject of this hearing, additional hydrocarbon controls, but more so by the indirect subjects, the inadequate knowledge, fuzzy thinking, and oblique rationale that have led us to this hearing today. We must not continue unalterably down this present chaotic path. It is time to assess the past, present, and future of the total plan.

Our member companies fully support the goal of providing clean, healthy air for the citizens of this country. We feel we have contributed much toward attaining that goal. We have shared our industry's expertise in previous hearings such as this. We have allocated hundreds of man-years and millions of dollars in the implementation of the TACB regulations. Reactive hydrocarbon emissions from stationary sources in this region have been reduced by 160,000 tons, 53 percent, in the last three years. In fact, there are no significant stationary emissions of reactive hydrocarbons not now controlled.

The Texas Chemical Council's assessment of the present status of the plan toward attaining the goal of air free from harmful concentrations of photochemical oxidants is in brief:

(1) No satisfactory or consistent method of measuring and monitoring the pollutant, photochemical oxidants, has been established.

(2) The health effects of various concentrations of photochemical oxidants and therefore the standard are in doubt, since the measurement method has not been established.

(3) The strategy for control of photochemical oxidants is in error.

The TCC has provided a more detailed written discussion in a series of separate papers as a part of the record of this hearing. Today, we pause and look with alarm and misgivings at a plan based on inadequate monitoring and a doubtful ambient air standard requiring an unacceptable control strategy.

The goal of our plan, as stated in the statement of purpose of the Clean Air Act, is ". . . to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; . . .". The achievement of the goal requires:

(1) The ability to measure and monitor a pollutant, in this case photochemical oxidants;

(2) Establishing a relationsip between the concentration of photochemical oxidants and health effects and adopting a standard to protect health and welfare and the productive capacity of its population; and

(3) A control strategy to meet the standard.

First, let us discuss the measurement of photochemical oxidants. The Los Angeles County Air Pollution Control District (APCD) started the chain of events which has led us to a totally confused air quality monitoring position today. In the 1950's and 60's, the Los Angeles District used a continuous, neutral, phosphate-buffered potassium iodide method to measure "total oxidants". This method measures ozone, aldehydes, peroxyacetyl nitrate (PAN), chlorine, bromine, sulfur dioxide, nitrogen dioxide, and hydrogen sulfide. Since most of the oxidants of concern are produced photochemically, the Los Angeles District and later the EPA called the measured pollutants "photochemical oxidants". Later this method was corrected for interference. Next a more suitable method called FAS was adopted for the EPA monitoring network. This method had only a 10 percent efficiency for ozone. Then, the EPA adopted the chemiluminescent method. It was efficient and specific for ozone, the major component of the Los Angeles "total oxidant" and assumed to approximate the original Los Angeles District method. This assumption is probably not valid for many cities. Recent evidence indicates that in some cases the chemiluminescent method reads as much as twice the continuous Los Angeles method. The uncertainty of the EPA standard method for monitoring is disclosed in the February 18, 1975, Federal Register. Herein the EPA states that the Nation's air pollution control program has a satisfactory air quality test method for only one air pollutant, sulfur dioxide. Without a consistent and established monitoring method, the entire air pollution control plan is precariously based, and of grave concern.

We strongly recommend that the first order of business be the adoption of a standard method for monitoring photochemical oxidants related to health. This task might best be undertaken by a group outside of those directly concerned, perhaps reporting to the National Academy of Sciences.

Now let's look at the national standard for just a moment, the second area for discussion. The standard was primarily based on health studies made in Los Angeles in the 50's and 60's. There was no doubt there were occasions when photochemical oxidants were a problem in that city. Tearful eyes and a distinctive odor were obvious manifestations to everyone.

These health-effect studies utilized the only available ambient air data, that of the APCD obtained by the continuous potassium iodide method. These data were used in establishing a relationship between the concentration of photochemical oxidants and health. These same health studies were the basic input to the EPA national standards set at 0.08 ppm in 1971. The standard was set from measurements using the Los Angeles District method but almost no measurements have been made in Texas over the past four years with this method. We are comparing apples and oranges to decide the seriousness of the problem, or whether there is a problem. It is imperative that a health standard be properly set.

Third, let us discuss the control strategy for photochemical oxidants. Photochemical oxidants are the product of hydrocarbons, nitrogen oxides, sunlight.

and time. The control strategy is based on control of hydrocarbon emissio more specifically reactive hydrocarbons. Formation of oxidants is very complex: different hydrocarbons react to form photochemical oxidants at different rates and to a greater or lesser degree, depending on what mixture of hydrocarbons and other pollutants is in the air. Despite these very complex reactions, the EPA has promulgated a control strategy which says that photochemical oxidants, as ozone, can be controlled by a proportionate reduction of hydrocarbons. The EPA further states that it should be assumed that there is no natural background concentration of ozone. Furthermore, the strategy presumes that the standard may not be exceeded more than one hour in a year by the total of the area's monitoring measurements in order to protect health and welfare.

There is considerable evidence that there is a very poor relationship between the hydrocarbons measured and the photochemical oxidants (ozone) measured in this region and many other parts of Texas. Second, there is ample evidence that there is considerable background ozone from natural sources, not only in this region but in many other areas. So-called minimum background ozone levels in some areas exceed the standard. Certainly an account must be taken of background ozone as it is for other pollutants.

Third, it is arbitrary and unreasonable to set the second highest measured value as representative of the level to which an area must control. In this region, the second highest value for 1974 was 0.20 ppm. However, the standard of 0.08 was exceeded only 3 percent of the time, based on 7,083 hourly measurements during the year. We suggest that use of the second highest one-hour value for purposes of determining the degree of control necessary is entirely unrealistic when it is realized that excursions may randomly occur from effects completely out of the control or knowledge of anyone.

Lastly, what will be the effects of the proposed additional controls? Some of these proposed controls will be the first to directly affect the citizens. These controls are estimated to require a direct cost in excess of 100 million dollars for this region alone. This is only the tip of the iceberg. The attendant social and economic costs have not been, nor can they be, estimated.

The proposed controls, outside of the reduction in vehicle miles traveled and the limitation on industrial growth, are calculated to reduce hydrocarbon emissions only 11–14 percent and almost certainly will have little effect on the ozone levels in this area.

The "biggies" of the proposed control strategy are reduction of the vehicle miles traveled and limitation of industrial growth. The "no-growth" regulation promulgated by EPA for this region will prevent the construction or modification of any facility that might emit hydrocarbons in excess of three pounds per hour or fifteen pounds per day. This emission level is not technically feasible nor economically viable. Local refineries, chemical plants, and petrochemical operations will be limited to their present size. Service stations similarly may be limited to their present number. New surface coating operations, dry cleaning plants, and printing plants may not be built nor existing ones modified. Other types of industries, commerce, and businesses will be limited. The logical consequences of this "no-growth" policy are relocation of people, death of income-producing activities, decline of property values, and other huge indirect economic costs and deprivations to citizens. Unless the concept of "no-growth" is promptly rejected, EPA is likely to extend such regulations to many, if not most, major urbanized areas in connection with either its "transportation and land use control" program or its "air quality maintenance area" program. Devastating effects on the populace will result in the name of protecting our health and welfare. The industrial "no-growth" regulation is totally unacceptable in light of our present knowledge and definition of goals.

In summary, the TCC believes that neither the EPA nor anyone else knows where we have been, where we are, nor where we are going in the control of photochemical oxidants. We have not defined the problem. We are blindly following a control strategy with no knowledge that this strategy will provide an air quality to protect health and welfare and no recognition of the cost-benefit relationships. We must stop and revise our plan.

No revised plan is acceptable unless

(1) A monitoring measurement method applicable to the photochemical oxidants' effect on health is properly defined and agreed to; unless

(2) The relationship between health effects and properly and consistently measured pollutant levels are redefined preferably by a fully accredited agency or group independent of the EPA and its enforcement role; unless

(3) A control strategy is developed which encompasses all the valid relationships, including social and economic considerations; and unless

(4) the public is provided real participation in the decisionmaking processes.

Therefore, the Texas Chemical Council recommends the following courses of action be undertaken immediately:

(1) The Texas Air Control Board petition for a review and justification of the oxidant standard and EPA oxidant control strategy; and

(2) That the Texas Air Control Board, the Texas State Attorney General, and other interested parties take immediate court action to prevent implementation of additional hydrocarbon regulations. Evidence introduced at this hearing and from other sources is sufficient cause to stop, reassess our plan, and correct its direction.

I thank you for this opportunity to express the views of our membership and would refer you to the more technical group of papers submitted to this hearing for additional details.

Mr. BROWN. Thank you very much, Mr. Cyphers. Mr. Gammage, do you have any questions?

Mr. GAMMAGE. Thank you, Mr. Chairman. More by way of a statement than a question, Mr. Cyphers, I think your testimony, in conjunction with that of Senator Bentsen and the other expertise that's been demonstrated here today in testimony from those with a technical knowledge, and Congressman Eckhardt's interrogation of Mr. Lozano established two things—First, we all know where we want to get, but there are large questions of exactly what we need to do to get there. And second that rigid and arbitrary standards that have no rational basis, at least as far as we can determine, may not be the best but may well be the most inefficient and expensive way of trying to get there.

The combined efforts of the public and private sectors, particularly with regard to local input, local experience and local expertise, are critical to getting to that goal, which is to promote and preserve the health of this community, both environmentally and economically. I thank you for your efforts and cooperation in this direction.

Mr. CYPHERS. Thank you very much.

Mr. BROWN. Mr. Cyphers, is there any serious conflict between the various local groups as to the mechanism for closer cooperation with EPA in structuring the necessary research? Obviously, I think, there's agreement on all parts that we do need a strong local input into the program. My question is: Is there serious conflict with regard to the mechanism of the local input? Does the Chamber want to hog the whole act or anything like that?

Mr. CYPHERS. Well, I think the committee that's already started certainly represents a fine approach. I would certainly recommend the chemical industry segment, particularly since it is so large in the Houston area, be a part of such a steering committee or liaison committee, and we certainly stand ready to offer people who can bring a great deal to bear in their technical expertise and industrial knowledge to such a committee.

Mr. BROWN. Well, it seems like a very reasonable approach. As a matter of fact, the chemical engineering profession has frequently made a substantial contribution to some of these environmental problems, and I would think that you'd have a very strong professional organization amongst the chemists and chemical engineers in this area. Well, we thank you very much for your contribution.

Our next witness will be Mr. Larry Feldcamp, who is chairman of the Houston Area Oxidant Study Steering Committee for the Houston

Chamber of Commerce. We appreciate your being here this morning. Mr. Feldcamp, and we look forward to your testimony.

Mr. **Feldcamp.** Mr. Chairman, if I may, I may deviate slightly from the text which you have in front of you to comment on some questions that were made to Mr. Lozano as to maybe some of the thrust of our study.

Mr. **Brown.** That's quite appropriate, and the full text of your statement will be included in the record and we will welcome any comments you have about the previous testimony.

[The prepared statement of Mr. Feldcamp follows:]

STATEMENT
OF
HOUSTON CHAMBER OF COMMERCE
HEARING OF THE
ENVIRONMENT AND ATMOSPHERE SUBCOMMITTEE
SCIENCE AND TECHNOLOGY COMMITTEE
U. S. HOUSE OF REPRESENTATIVES
NOVEMBER 21, 1977

The Houston Chamber of Commerce, concerned about the impact of Houston's growth on the quality of life of its citizens, has over the years sponsored and encouraged studies and projects dealing with such topics as mass transportation, health care, education, water and air pollution. Because of the recent concern by governmental agencies and others regarding the photochemical oxidants levels measured in the Houston area, the Chamber through its Environment Committee supported the creation of the Houston Area Oxidant Study (HAOS). Initiated in 1976, HAOS is a two-year objective, scientific study on the causes and impacts of airborne oxidants and haze in Houston and surrounding areas along the Texas Gulf Coast. HAOS includes technical studies in four subject areas:

(1) Air quality definition of ozone and other oxidants
(2) Air quality definition of haze
(3) Health effects of air pollutants
(4) Socioeconomic effects of control measures

A more detailed description of the individual projects and their status are set forth in the HAOS 12-Month Status Report, dated November 1977, which we request be made part of the record of this hearing.

HAOS is financed by contributions from about 200 private organizations in the Houston area. Augmenting the HAOS projects, however, are data obtained from public and private sources, the value of which, if financed by HAOS, would add over $4 million to the $1.3 million HAOS budget. Cooperating public agencies include the City of Houston, Texas Air Control Board and the Environmental Protection Agency.

All HAOS data will be publicly available for use by private and public groups. A data archive, consistent with EPA's system, has been organized and designed so as to provide a stepping stone for future detailed studies on Houston air quality and its effects.

Although it is the goal of HAOS to obtain the information and data on oxidants and haze to provide a sound basis for developing realistic and effective control strategies for achieving clean, clear, healthy air, it is recognized that additional studies beyond HAOS are necessary to achieve this goal. Based upon the experience of HAOS in developing and implementing their study program, we recommend that one of the initial projects, using the HAOS health effects study as a starting point, be the development of a comprehensive long-range plan for determining the health effects of aerosols, ozone and other oxidants as well as other criteria pollutants that may pose a health problem in the area. In developing its health effects study, HAOS went through a similar planning process which was felt to be very useful. In considering the health effects study to be implemented, consideration should be given to the following:

(1) Expanding the present HAOS epidemiological study to a second city which can be used as a control case, as well as extending the study for a longer period of time;

(2) Conducting a clinical ozone/oxidant study; and

(3) Conducting epidemiological study of metals in aerosols.

In other areas we recommend that the following projects be considered for inclusion in any future Gulf Coast air pollution study:

(1) A detailed analysis of particulate samples collected by HAOS for metals content;

(2) Development and implementation of improved methods and techniques for aerosol collection and identification;

(3) Conducting large outdoor chamber studies of Houston air to determine the potential for aerosol and oxidant formation;

(4) A detailed analysis of organic compounds in the ambient air;

(5) A further detailed three-dimensional analysis of oxidants, nitrogen oxides and hydrocarbons in the ambient air; and

(6) Expanded meteorological data collection and analyses.

The primary objective of HAOS is to perform a credible, factual, scientific study of the Houston area air pollution problem. We emphasize the words "credible" and "factual" as they are very important in connection with any air pollution research. HAOS has made a concentrated effort to establish the credibility of its study, such as by conducting an extensive quality assurance program and seeking the advice and assistance of federal, state and local regulatory groups as well as other air pollution and medical experts.

We believe that the EPA will be confronted with credibility problems if they perform the study on the Gulf Coast without the involvement of local interests. In such a situation the expenditure of $1 million may provide additional information and data but not a resolution of the Gulf Coast air pollution problems. This could in effect result in the wasteful expenditure of $1 million of the taxpayers' money.

Therefore, to assure the highest possible credibility and to make maximum and expeditious use of federal monies, we strongly endorse and support the need for close coordination and cooperation between the EPA and local and private interests with respect to any future air pollution research on the Gulf Coast. Only through such coordination and cooperation can there be a mutual understanding of and solutions to the air pollution problems.

Based on the experience of HAOS, we recommend that future Gulf Coast research activities be outlined and coordinated through a local Steering or Advisory Committee, who would provide general direction, and a Technical Subcommittee, who would define the specific research projects. The Steering or Advisory Committee should include the recently formed Gulf Coast Air Pollution Research Committee on which there are representatives from the Texas Air Control Board, Harris County, and City of Houston as well as from industry, citizen groups, medical associations, and universities. In view of the broad base of this committee, it can bring together the considerable expertise and resources in this area that can be utilized along with EPA's expertise and resources in resolving the area's air pollution problems.

We earnestly solicit your committee's endorsement of the close coordination and cooperation between EPA and local interests in the implementation of air pollution research on the Gulf Coast and any assistance that you may provide in effecting such cooperation and coordination.

Mr. Feldcamp. I also would like to make part of the record the 12-month status report on the Houston area oxidant study, dated November 1977, which gives more detail about our study.

Mr. Brown. Without objection, that will be made a part of the record, also.

[See appendix III, page 355.]

Mr. Feldcamp. As indicated in the statement, one of the four major study areas is air quality definition of ozone and other oxidants. Now, in the context of your questions previously, this is really an expanded monitoring network for ozone and other photochemical oxidants—including not only the normal methods of measuring total oxidants, but some specific compounds like the PAN, or peroxyacetyl nitrate, which is thought to be the cause of eye irritation in some areas. A second study area is the air quality definition of haze. We think we have some study projects which have not been done before here in the Houston area, to define the amounts of respirable particulates, to try to analyze the aerosols, both chemical and physical analyses. Third, and this is one of the most important areas of the study, is the health effects which we think is unique. This is probably the first time this has really ever attempted to be done on a broad basis here in Houston. as far as we're aware. And we're trying to correlate the measurable health effects with measurements of these various pollutants, including the aerosols. The fourth area is the socioeconomic effects of control measures, both the benefits and the negative aspects of these control measures.

As indicated in our statement, our study has a budget of $1.3 million, but I think I would make mention that really the study, in effect, if we had to pay out cash for everything that we have done it was really more than $5 million, because we have received contributions of services in kind, if you will, from the State, the city, other private organizations—especially in the monitoring network. The great heart of our monitoring network is the city of Houston, and the Texas Air Control Board systems, but which we have expanded considerably. All our HAOS data will be publicly available for use by public and private groups, and data archives consistent with EPA systems have been organized and designed so as to provide a stepping stone for future detailed studies on Houston air quality and its effects. Although it is the goal of HAOS to obtain the information and data on oxidants and haze to provide a sound basis for developing realistic and effective control strategies for achieving clean, clear, healthy air in this area, it is recognized that additional studies beyond HAOS are necessary to achieve this goal. Based upon the experience of HAOS in developing and implementing their study program, we recommend that one of the initial projects, using the HAOS health effects study as a starting point, be the development of a comprehensive, long-range plan for determining the health effects of aerosols, ozone, and other oxidants, as well as other criteria pollutants that may pose a health problem in the area. In developing this health effects study, HAOS went through a similar planning process, which was felt to be very useful.

As to specific projects, consideration should be given to the following: Expanding the present HAOS epidemiological study to a second city which can be used as a control case, as well as extending the study for a longer period of time; second, conducting a clinical ozone/ox dant study; and, third, conducting an epidemiological study of meta and aerosols. In other areas, we recommend that the following projects be considered for inclusion in any future gulf coast air pollution study: A detailed analysis of particulate samples collected by HAOS for metals content. Second, development and implementation of improved methods and techniques for aerosol collection and identification. Third, conducting large, outdoor chamber studies of Houston air to determine the potential for aerosol and oxidant formation. Fourth, a detailed analysis of organic compounds in the ambient air. Fifth, a further detailed, three-dimensional analysis of all oxidants, nitrogen oxides, and hydrocarbons in the ambient air. And sixth, expanded meteorological data collection and analyses. The primary objective of HAOS is to perform a credible, factual scientific study of the Houston area air pollution problems. We emphasize the words credible and factual as they are very important in connection with any air pollution research. HAOS has made a concentrated effort to establish the credibility of its study, such as by conducting extensive quality assurance program, and by seeking the advice and assistance of Federal, State and local regulatory groups, as well as other air pollution and medical experts. We believe that EPA will be confronted with credibility problems if they perform the study on the gulf coast without the involvement of local interests.

In such a situation, expenditure of $1 million may provide additional information and data, but not a resolution of the gulf coast air pollution problems. This could, in effect, result in the wasteful expenditure of $1 million of the taxpayers' money. Therefore, to assure the highest possible credibility and to make maximum and expeditious use of Federal moneys, we strongly endorse and support the need for close coordination and cooperation between the EPA and local and private interests, with respect to any future air pollution research on the gulf coast. Only through such coordination and cooperation can there be a mutual understanding of and solutions to the air pollution problems. Based on the experience of HAOS, we recommend that future gulf coast research activities be outlined and coordinated through a local steering or advisory committee, who would provide general direction, and a technical subcommittee, who would define the specific research projects. The steering or advisory committee should include the recently formed Gulf Coast Air Pollution Research Committee, on which there are representatives from the Texas Air Control Board, Harris County, and the city of Houston, as well as some industry and citizens groups, medical associations, and universities. In view of the broad base of this committee, it can bring together the considerable expertise and resources in this area that can be utilized along with EPA's expertise and resources in resolving the area's air pollution problems. We earnestly solicit your committee's endorsement of the close coordination and cooperation between EPA and local interests in the implementation of air pollution research on the gulf coast and any assistance that you may provide in effecting such cooperation and coordination. Thank you.

Mr. BROWN. Thank you very much for your statement, Mr. Feldcamp. It answers a number of questions that I had.

As far as I can tell, there should be no problem in coordinating the Chamber's operations with the other programs in the area for a closer relationship with EPA.

Mr. Feldcamp. I don't see any problem at all.

Mr. Brown. There will, of course, always be a suspicion on the part of some people that the Chamber or the local business groups and chemical industry have an ulterior motive, in wanting this coordination. I think that it would be an error to assume that. It is the local business community that has a financial stake in the success of this program and in the viability of this community, and without their assistance I doubt if any control strategy would work very well. Would you concur in that?

Mr. Feldcamp. I would concur with that. We need a mutual understanding for mutual solutions to the problem.

Mr. Brown. Thank you very much. That will be fine.

Our next witness will be Dr. Herbert C. McKee, who is Assistant Health Director for Pollution Control of the City of Houston's Health Department. We're happy to see you here, Dr. McKee, and look forward to your testimony.

Dr. McKee. Thank you, Mr. Chairman. I'm delighted to be here and to testify at this hearing. We're talking about a matter which is of grave importance to public health, and by accident or design I'm the only person on the list of witnesses whose full time professional responsibility is public health.

Mr. Brown. It's a tribute to your high competence, doctor. We knew you could deal with your job as representing all the people concerned with this area.

Dr. McKee. Thank you, Mr. Chairman. Many of the other agencies that are represented here are concerned with public health, but not as a full time, sole activity as is the case with our city health department. We have a comprehensive air pollution control program within that department which includes monitoring, compliance inspections, engineering studies and enforcement, all intended to improve air quality in the city of Houston. Based on that experience, I would like to discuss the need for the research studies that are being considered at this hearing.

First of all, the charter for this hearing mentions the fact that different cities have different climate and other factors that influence air pollution problems, and that solutions to these problems need to be changed to reflect those conditions. Certainly, this is true of Houston, as we've heard many times this morning. Our control efforts have achieved a high degree of success in reducing sulfur dioxide, carbon monoxide, many local nuisance problems, and in other ways. But lack of knowledge has caused previous control efforts to fall far short of our objectives in the control of photochemical oxidants, as shown by the high ozone readings which still occur. Based on the control requirements of the Environmental Protection Agency, hundreds of millions of dollars have been spent in Houston to reduce hydrocarbon emissions in the belief that this would reduce the ozone episodes.

This includes the cost of very substantial control measures by local industries, and also many millions of dollars spent by the average car-owner for catalytic convertors, unleaded gasoline, and other vehicle control measures. These efforts have undoubtedly improved air quality in many ways, and I'm not sorry that those measures have been implemented. But in terms of the original objective of decreasing the ozone episodes, they have been a failure. Ozone episodes have not changed in either frequency or severity by any measurable amount, in spite of the very massive expenditure and the substantial reduction in hydrocarbon emissions that has occurred in the last few years. Some of the community leaders in Houston are naturally rather dismayed at this expenditure without achieving the desired and announced objective. It is obvious that additional control measures are needed, but it is also obvious that these control efforts must be effective if public disillusionment and loss of credibility for future control efforts are to be avoided.

I'd like to address a question raised previously by Congressman Wirth. He asked if there was public support for air pollution control efforts in the Houston area. As one who is in contact with the public every day concerning air quality in the Houston area, I can assure him and you that the answer is a resounding yes. The hundreds of millions of dollars that have been spent are positive evidence of that support.

But that support will not continue indefinitely, if future expenditures continue to fail in reaching announced objectives. We can achieve a lot with the control measures that have already been implemented, but since that was done to reduce ozone episodes and it has not done so, the public is not going to regard our efforts as a resounding success. When we start on a revised program to spend additional hundreds of millions of dollars, we will have public support. We have it now. But we cannot afford to fail too many times in succession, if we want to maintain that public support. That's why it is important to talk about the research needs of this area. We need to understand the unique nature of our problems here in Houston, and without that understanding there can be no assurance that our future control efforts to reduce ozone episodes will be any more effective than our past efforts, no matter what other benefits those efforts may produce.

Based on our experience and observations, several suggestions are included in my written testimony for consideration in this research effort, and I'll review those briefly. First of all, the effects on human health should be determined in the Houston area. We have reason to believe that our problems are unique enough in this area—although there are certain common factors with other cities—that what we know about health effects in Los Angeles or Chicago or what happens in a laboratory in North Carolina does not give a complete and an adequate understanding of the health effects in Houston.

Second, the role of oxides of nitrogen should be determined, as was discussed before by Mr. Eckhardt and others. There is some evidence which suggests that no amount of hydrocarbon reduction—50-percent, 60-percent, 90-percent, or even 100-percent reduction of manmade hydrocarbons—would achieve the oxidant standard, so long as oxides of nitrogen are not also reduced along with the hydrocarbon reduction. If that tentative conclusion is confirmed by further research, the importance of such a conclusion in devising future control strategies is almost beyond calculation.

Third, the relationship between ozone and other constituents of photochemical oxidants needs to be better understood. We measure ozone because there is a convenient and accurate method of doing it.

But we do not need to control ozone to protect public health, at least at the levels existing in Houston most of the time. We get pretty close to that level, and I worry some about ozone on its own merits. But I worry much more because of the potential health hazard of the other constituents that may or may not occur along with the ozone that we're measuring. So we certainly need to address the relationship between ozone and other constituents of photochemical smog before we can really understand potential health hazards and be able to alleviate them.

Other speakers have mentioned the role of small particles and the haze formation, along with the ozone episodes that occur, and this is extremely important. We don't know what role these small particles have in causing effects on human health. There's another haze problem that I would like to separate from that one, and that is the haze that we get when we do not have elevated ozone levels. We may have two separate haze problems—one with ozone, one without. We need to understand the health implications of both, so that we can deal with them effectively.

Another major topic is the role of vehicle exhaust. The conventional understanding of photochemical smog assigns vehicle exhaust a major role in its formation, and yet there is some rather conclusive circumstantial evidence that in Houston the role of vehicle exhaust in our ozone episodes or in photochemical oxidant formation is much less—perhaps almost negligible—compared to that conventional understanding. The city of Houston has accomplished much to reduce vehicle traffic—a better bus system, a park and ride system, a carpool program on a citywide basis—and these are going to continue. These programs are going to benefit air quality, to some extent at least. But certainly the very expensive and restrictive transportation control measures that have been advocated by the Environmental Protection Agency in the past should not be imposed on the public unless there is much more definite proof than now exists of the need for measures of that type.

The final area that I would like to mention has also been mentioned before; the new and additional problems we face in the future due to conversion to coal. Widespread use of coal is certainly essential as a national objective, because of the need to reduce oil imports and also because of the price and availability of alternate fuels. But it is also essential to think about public health in that conversion to coal, or with whatever measures we ultimately devise to meet our energy problems. With 40 or 50 large industrial plants in a limited geographical area along the Houston Ship Channel even the best and most modern control technology will not be adequate to avoid hazards to public health if all of them are forced to convert to coal. For this reason, research studies should be started now to see what additional health hazards will be caused by sulfur dioxide and small particles from burning coal. These hazards will be added to the existing problems that already occur in that area. There is some scientific evidence indicating that ozone and sulfur dioxide together are much more damaging than either one by itself. and since we already have high ozone episodes, the addition of significant amounts of sulfur dioxide might create much more serious problems than exist at present. Among other possible solutions, I certainly hope that the energy legislation which is now pending in Congress will provide for some continued use of natural gas for industrial use, in urban areas where large numbers of industrial sources exist in close proximity to each other and also close to residential areas.

These are some of the technical and engineering areas that we think are of paramount importance in the research efforts that are needed in this area, so we can understand our problems and control them more effectively than we have in the past. If future research can provide an adequate understanding—or even a reasonably adequate understanding—of these problems, certainly our efforts will be more successful than they would be otherwise. But it is obvious to us that such research needs to be done on a local or a regional basis.

The city of Houston Health Department is not a research organization, but we do have a monitoring network, and we have scientists and engineers who are involved in every phase of our local control program. These people provide a reservoir of talent that could be useful. We have already furnished air monitoring data to the Houston Area Oxidant Study and to other health effects studies in the Houston area, and with some expansion of these activities we could be of even more help in future research efforts that are undertaken.

Finally, let me observe that the Clean Air Act provides for national standards that in the words of the act "are requisite to protect the public health." As a representative of a local health department, let me assure you that the city of Houston wants the same protection for public health as any other city. But our experience indicates that these national standards must be implemented in different ways in different cities, because of the variations between different cities—which you mention in your charter for this hearing—if these different cities are to achieve that same protection for public health which we want.

This can only be achieved by developing control measures that are tailor-made for the local conditions of each region. Without additional research to identify and understand these local conditions, our future efforts cannot be completely successful. We appreciate your interest, and look forward to further cooperation in planning and conducting research that will aid in meeting our common objectives in the public interest.

Mr. Brown. Thank you Dr. McKee, that will be very helpful. Mr. Eckhardt?

Mr. Eckhardt. Dr. McKee, your qualifications in this field are of course well known in this community, and I think they must be understood by the committee after hearing your testimony. I have been troubled by one thing, and I don't know whether you can answer this or someone else can. We talk about a reduction by 40 percent of hydrocarbon levels in the air in this area, and I assume that's over a certain number of years—I'm not sure how many years—and I'm not sure where we start as compared to hydrocarbon content of the air in other parts of the country, or in comparable areas.

Dr. McKee. First of all, that's a 40-percent reduction in what we can identify by means of an emission inventory. The city of Houston furnishes some data and cooperates with the Texas Air Control Board in compiling this inventory. If there are sources that have not been identified and included in that inventory, they don't affect either the beginning or the final figures in that 40-percent reduction. The 40 percent occurred approximately between 1973 and 1975 or 1976. It is probably a little bit more than that now, although I'm not sure that our figures are accurate enough to add a few more percent to the total. But certainly it is something in the range of 40 to 50 percent total reduction since about 1973.

Mr. ECKHARDT. How do we compare with respect to the amount of hydrocarbons in the air as compared to a comparable city of this size—is there any way to gage that question? Are we way up above most areas in hydrocarbon content, are we about average, or what?

Dr. MCKEE. There are several things to consider. In terms of total tonnage, we started out higher than an urban area might be expected to have with our population, 2½ million, more or less. This is because of the very large contribution of the industrial component, but that industrial contribution has now been reduced to perhaps 10 or 15 percent or, at most, 20 percent of the previous figure, so that portion is a lot less than it once was in terms of total tons emitted to the atmosphere.

Let me also mention oxides of nitrogen. The industrial contribution to oxides of nitrogen is about two-thirds of the total for this entire urban area. Furthermore, that two-thirds is concentrated primarily in the ship channel area, which is a small portion of the total metropolitan area. Most of the remaining one-third comes from motor vehicles, but those vehicles are spread out throughout much of the city and beyond. In term of concentration in a given air mass, the industrial contribution to oxides of nitrogen is much more than the 2:1 ratio of absolute tonnages. Our hydrocarbon emissions at the present time are probably in the range that one would expect for any city of 2½ million—or maybe a little higher—but since the city is spread over a wide geographical area, maybe the total amount isn't of paramount importance. But one important factor about oxides of nitrogen is what the effect may be of that concentration in the ship channel area, which amounts to two-thirds of the total tonnage but is much more than that in terms of concentration in a limited region or a given air mass.

Mr. ECKHARDT. Thank you. Thank you, Mr. Chairman.

Mr. BROWN. May I pursue that just for a moment? Mr. Eckhardt was trying to raise a question that would differentiate between emissions and concentrations, and yet I'm still a little confused about that. Can we use an index of emissions as a surrogate for concentrations on the theory that the atmosphere is washed out every day or periodically and so it's only the emissions?

Dr. MCKEE. No, sir, not directly. The total emission in tons is only a starting point, and one must then consider what happens to that amount over a few hours or days before one can really understand what the tonnage figures mean. To illustrate, let me make a comparison between Houston and Los Angeles. In the Los Angeles area—or the South Coast Air Basin, which is a term you're probably familiar with—a given air mass drifts back and forth within that basin, receiving more pollutants and reacting to form more oxidants for as much as 4 or 5 days, under stagnation conditions. So an air mass that finally leaves that area is about 4 or 5 days old, and contains the accumulated byproducts of that area and the reaction products for 4 or 5 days. In Houston, due to the relatively flat terrain and somewhat better wind velocity, that degree of stagnation is almost inconceivable. Under most stagnation conditions that occur, a given air mass passes into and out of the Houston area in, at most, 18 to 24 hours. Of course, there may be exceptions, but if there are we haven't identified them. We had series of 10 consecutive days in June of this year with high ozone readings, but that was not the same air mass; there was some new air coming into the area each day and some going out each day. In terms of the atmospheric reactions that occur, it is necessary to consider the difference between continually reacting for 4 or 5 days in the South Coast Air Basin, or reacting for only 18 to 24 hours in the Houston area.

That is certain to change the chemistry of what happens in the atmospheric reactions, and therefore change the final products of that reaction system. That is one illustration of the difference—you can't take the total tonnage in Houston and divide that into the total tonnage in the South Coast Air Basin and assume that we have one fourth or one fifth of the problem that occurs in southern California.

Mr. **Brown**. All right, that helps me to understand the situation. What you've said in general applies, then, to all of the pollutants—the ozone and other things as well.

Dr. **McKee**. It doesn't apply so much to meeting the present standards for carbon monoxide and sulfur dioxide, because the carbon monoxide that goes out of the tailpipe of an automobile is still carbon monoxide when it gets diluted and ultimately removed from the atmosphere. So you don't have the complication of the very complex reaction systems that produce ozone and other oxidants. You do have to consider atmospheric dispersion patterns in any area—Houston or any other area—to know what those tonnage figures mean. But it's a much more complex situation in evaluating oxidants, because one must start with the total amounts of hydrocarbons and oxides of nitrogen, then consider how these are dispersed and mixed by meteorological conditions, and then consider what reactions occur in the atmosphere during this mixing to produce the ozone and PAN and other products that we're worried about because of their potential effect on human health.

Mr. **Brown**. Well, we thank you very much for your contribution, Dr. McKee. It's helped my understanding of the problem and I'm sure the other members of the committee.

Dr. **McKee**. Thank you very much, Mr. Chairman. We appreciate your presence here and we would like to invite you to come back to observe our progress as we learn more about this problem in the future.

Mr. Brown. You can count on our being back. Our last scheduled witness this morning is Ms. Mary Rollins, representing the Citizens Clean Air Advisory Council.

Ms. **Rollins**. Congressman Brown, I assume you saved the best until last?

Mr. **Brown**. You may assume that.

Ms. **Rollins**. Thank you. I'm not going to read my testimony because I understand you must all eat lunch and then catch a plane, and I think much of what needed to be said today has been said. But let me reiterate a few things that I think are very important. I am vice chairman of the Citizens Clean Air Advisory Council, a group of citizens—we call ourselves, I think, practical activists—we would like to see things done in cleaning up our air and I can assure you it is a frustrating business at times. I'm also a member of the steering committee, the liaison unit, to guide EPA research on the gulf coast on air pollution.

We were invited for the first time to a meeting on October 19, that Mr. Lozano referred to, several of the people referred to, and I think it would be only fair for me to report that we, as kind of outsiders and stragglers, were very taken aback to see that many of the people that we assumed were in the business of taking care of the air—EPA, Texas Air Control Board, School of Public Health—all the other groups who were there representing what they say is public health, that many of them had met each other for the first time.

Several hadn't seen each other for a very long time, and some had only corresponded. This didn't lead to a great deal of equanimity in the citizens' eyes, because we felt that they were about their business of cleaning up the air. Now, most certainly, they have been working at it very hard. But not to take exception to some of the testimony that has been given here this morning, there was reference by Dr. McKee of the strides that we have made in public transportation. I have been involved in that for quite a few years, and I think if you look at the record we have fewer than 2 percent of our people who take public transportation. Beyond that, we have 300 newly registered vehicles that come into Harris County per day. Now you can talk about reduction, reduction, reduction, but if 1 plus 2 plus 3 add up to something then perhaps we have a problem that we really haven't addressed. Beyond the things that we are looking into—and I'm very concerned about the use of coal in this area—I keep thinking that in the wisdom of the Congress perhaps we will be allowed to keep what natural gas is here, but I think that would be a foolish assumption. But once we start adding sulfur to the atmosphere I wonder what else it is that will come forth. I think it all points to what the others have said here and the reason for you being here today, and it's the real, necessary reason for research in this area—an ongoing program that will not just measure what is there—we need to know that—but also the acute health problems and the long range chronic problems.

There are references that I have made to my testimony that have not come from environmental manuals but from industry and from Mr. Barden, then executive director of the Texas Air Control Board, when he testified before your committee on February 23. He spoke then of the inadequate research that we have and of his concern for the presence of carcinogenic and otherwise toxic materials in the ambient air. Even Fortune magazine that is not necessarily known as a pro-environmental magazine, saying in November of 1976 that we know very little of the thousands of new substances like the PCB's that are finding their way, not just into the air, but into the water and food. Most of these are present at low levels, but many are known to be toxic or carcinogenic and only a few are now controlled. To me that just screams for research, and it's you people who have the mechanism to see that we get it here in Houston.

I will say that the several times that we have met with the steering committee, I think that it is a working committee, I think they are reasonable, I know for sure I am, and I feel that there is a great deal of work that we can do. Last night the HAOS study was presented to our environmental group, and I must say that I was impressed, because my suspicions were. I should say, not golden. I was wondering why would these people be spending that kind of money, and having been involved in research myself I do know and am fairly good at slanting arguments in the way I'd like to see them go. So the HAOS peopl have turned up with an incredible amount of data that needs to be assessed, but only with the help that perhaps you gentlemen on this panel can provide will we find some of those answers.

Do you have any questions?

Mr. BROWN. Well, let me thank you for your testimony. We do appreciate your input. Our agenda was not overloaded with representatives of public interest groups this morning, and you have an important contribution to play. Do you have any questions, Mr. Eckhardt?

Mr. ECKHARDT. No, no questions, but I might say to Ms. Rollins, as well as some of the other witnesses, that the conference committee has now completed their work on what is called the coal conversion provisions of the Energy Bill. In that is the recognition of the need to continue to use gas in certain nonattainment situations. In addition, of course, with respect to coal conversion in the electric utility field, the deadlines are quite short. They call on us to use our maximum efforts to try to solve these questions before there is too much coal moving into an area.

Ms. ROLLINS. How about the study that has just, I think, started at the University of Arizona. Will you benefit from that? It is a $6 million fund that is beginning to look into what coal conversion will cause, and so I'm hoping that we, too, will benefit from what they find out there.

Mr. ECKHARDT. Thank you, Mr. Chairman.

[The prepared statement of Ms. Rollins follows:]

TESTIMONY BEFORE THE SUBCOMMITTEE OF THE ENVIRONMENT AND THE ATMOSPHERE OF THE U.S. HOUSE OF REPRESENTATIVES SCIENCE AND TECHNOLOGY COMMITTEE

MARY ROLLINS, VICE CHAIRMAN, CITIZENS CLEAN AIR ADVISORY COUNCIL, HOUSTON AREA

I'm Mary Rollins, vice-chairman of the Citizens Clean Air Advisory Council, Houston area, and a member of the steering committee, liaison unit to guide EPA research on gulf coast air pollution.

According to your invitation for me to speak here before you gentlemen today, you asked that I address certain issues pertaining to urban air pollution problems. There are other spokesmen here who have more expertise than I. For that reason I shall resort to testimony that you heard February 23, 1977 concerning our local problem from then executive director of the Texas Air Control Board, Mr. Charles R. Barden, P.E. He clearly stated that his capable staff "found fragments of information—largely from other parts of the country—available data and research information so totally inadequate that little more can be done until some reasonable amount of data and research information relevant to local conditions can be collected". He spoke to you of the pervasive brown or gray haze which hangs over most of the nation's larger cities" and that "the presence of careinogenic and otherwise toxic materials in ambient air is the other major concern".

Along that same line, Mr. Tom Alexander, in an article published by Fortune magazine, November 1976, wrote that "there's good reason to suspect that even now we may be spending too much money and manpower on pollutants that are no longer much of a problem, while neglecting pollutants that are genuine hazards. In particular, very little is known about thousands of new substances that, like the PCB's, have been finding their way into water and air. Most of these are present in low levels, but many are known to be toxic or carcinogenic, and only a few are now controlled".

These statements, to me and I hope to you gentlemen, point to the need for an adequately funded on-going research program whereby these toxic substances and carcinogenic substances can clearly be identified as hazardous or nonhazardous. Only then will we citizens know if the air we breathe here in Houston allows an adequate margin of safety to protect the public health. Too, you gentlemen must concern yourselves with the transport problem. It is common knowledge that if we are fortunate enough to get a "northerner" we've little or no haze for a day or two but that when we get a "southerner" there are a few complaints beyond the northern limits of Harris County and the southern limits of Montgomery County.

With our current low level of knowledge, it is rather difficult if not impossible to state whether the air here is unique or unusual. We think it is but thinking alone doesn't constitute a reasonable amount of data and research information relevant to the local condition.

There will be testimony here today from heads of the regulatory agencies who will tell you much as they've told me, that "We've turned the screws as tight as we can on industry and even with the additional emphasis on better catalytic converters, the problem is still here".

Perhaps more regulations won't improve the air appreciably but enforcement should continue. For sure there shouldn't be a moratorium on regulations while we await the results from the needed research.

As concerns strategies, you ask if there are alternatives to the controls. Several have been suggested. First, the U.S. EPA in a publication by the National Academy of Sciences, Washington, D.C., 1977. It refers to the use of economic incentives as an approach to environmental management. It argues in favor of the economic incentive over the present emission standard.

Another person who agrees with that approach is Dr. Wilfred Beckerman in his popular book "Two Cheers for the Affluent Society." He states that "pollution can be controlled when it is recognized that the problem is not growth but a misallocation of resources." "Because we do not consider that people 'own' clean air, clean water, 'quiet' and so on, we cannot easily extract payment from people who use them by polluting them. Hence, the costs of pollution are not usually borne by those that are responsible for the pollution, but instead by the victims."

If we've a dearth of knowledge on the physical-chemical nature of the local problem, then we've scant knowledge on acute health effects and an exiguous knowledge of chronic health effects. What studies exist in Houston have been sent to the EPA. Others here today will speak to it but in talking with them and from our own work into the air pollution problem it is very clear that we need research where we hope to find out what is in the air, how elements and compounds react and interact and what the effects are ecologically and more importantly bodily over both short-term and long-term. The cost of adverse impacts such as health effects cannot be calculated or estimated until we know what it is we breathe. I suspect the cost is very high indeed but there are others here today who will argue that the benefits far outweigh the risk. Only with a better information base will we stand a better chance of presenting facts rather than suspicions.

In your question on how local groups should make input into the research planning, I believe that we citizens witnessed and became part of the process beginning October 19, 1977 when EPA invited us to participate in the planning. We representatives of the Citizens Clean Air Advisory Council were there with EPA, TACB, city and county pollution control, U. of Texas of School of Public Health, Houston Chamber of Commerce, Rice U. and several other representatives.

We citizen representatives were somewhat surprised to see that several people from these agencies met for the very first time, others had corresponded only and others had not seen one another for a long time. We reached a consensus that it is rather difficult to expect "cooperation" between agencies when there is in fact very little "communication."

But, the communication did begin which is important and it is my hope that our steering committee will continue to exist and for the betterment of air quality in Houston that it function as well.

In summation, we citizens ask that the ambient air quality standards be set so that their attainment and maintenance allow an adequate margin of protection of public health, that the degree of protection be constant across the country, that the Congress make a firm commitment to an adequately funded long-term research effort so as to identify and deal with acute and chronic health effects here in Houston and the gulf coast.

Mr. Brown. Thank you very much, Ms. Rollins, for your testimony, and may I urge you to continue to cooperate with the local groups. You can help keep them honest, possibly. We have one final witness who was originally scheduled to be first this morning, and instead will be last this afternoon, the Honorable John Hill, Attorney General of the State of Texas, and we welcome him here this afternoon.

Mr. Hill. Mr. Chairman, I am grateful to you for permitting me to appear before the distinguished subcommittee. I know you've probably endured about all you ought to have to endure by way of statements here today, but I do feel deeply about this subject and your presence here, so permit me if I might to have a word about our concern over the need for additional research into the air pollution problem in Houston and Harris County, and feel free, of course, to interrupt me at any time for any question you might have.

Mr. Brown. May I say, Mr. Hill, that your commitment and diligence to getting here and testifying indicates the importance of the subject, and we do appreciate it.

Mr. Hill. Well, you're kind to say that, but I did almost 5 years ago now, when I became attorney general of this State, January 1, 1973, enter the office with a strong environmental platform, with a pledge to enforce the environmental laws of this State, and particularly here in the gulf coast where I'd spent most of my adult life, and like everyone else living here was familiar with the serious air pollution problem that we did have and, to some extent, of course, still have. We've tried to keep that pledge and I'd like to give special recognition to the late Dr. Quebedeaux, to whose efforts all of us owe so much. We worked jointly with Dr. Quebedeaux and with the city of Houston. I'd also like to pay my respects to the people that have worked in that department so diligently and to the Air Control Board, one of our really better clients that we feel have done a good job in trying to reduce the amount of air pollution in this area. And I also want to say that there's been significant voluntary compliance by local industry in helping us work out this problem. I can say with, I believe, a reasonable degree of certainty that as a result of all that cooperation and working together that there is not a single major emitter of air pollutants in the gulf coast area that's in violation of our State implementation plan, our State regulations. These efforts have resulted in a tremendous reduction in the contaminants that are being emitted into Houston's air, and I don't think there's any doubt that if it hadn't been for those efforts that air pollution here would be far worse than it is today, and indeed would probably be among the worst in the world.

But despite these important gains, one does not need to be an environmental specialist, Mr. Chairman, to realize that we still do have a major air pollution problem. One need only live here and breathe the air to know that. And having worked closely with air pollution experts for the last 5 years, it has become increasingly obvious to me that our air pollution problem in this area transcends the five Federal criteria pollutants, and the control strategies for those pollutants. And the EPA has understandably concentrated its efforts on problems that appear to be common throughout the Nation. And that's understandable—it's aimed its programs at the handful of pollutants that it is believed would have the most significant health effects nationally. But as they've done so, it seems to us that other problems have gone unsolved. And that's why we believe it's imperative, Mr. Chairman, that Congress do provide the EPA the resources and that EPA use those resources so that the next phase of pollution control in this area can be aimed at providing programs that recognize and seek to solve what we believe may well be a regional problem, to some extent.

Now the new $1 million study for Houston is an excellent first step, but a first step is all that study could be. Houston's unique air pollution problem, it seems to us, demands more. And as I'm sure you're aware, Mr. Chairman, Houston's air pollution does not fit the traditional model for air chemistry developed from the Los Angeles studies and studies of other major cities in the country. The combination of a warm climate, high humidity, close proximity to the ocean and the high concentration of petroleum and chemical industries causes, we believe, some uniqueness to this situation. As one result, the aerosol haze in Houston is really not being reduced significantly under our current program. And this is particularly disturbing because a large percentage of these aerosols are within the particle size range, which seems most likely to be able to cause adverse health effects. That has to concern us all.

The failure of present Federal programs and the State's programs to which they are tied by law, the failure of those programs to solve those problems, it is only part of the reason this committee should, we believe, be interested in further research for this part of the United States, because Houston provides a unique opportunity to examine problems associated with new fuel conversion programs. Since Texas has an abundance of clean burning natural gas, the Houston air has not been significantly contaminated, for example, with the sulfur compounds common in other areas where coal and oil are burned. And that situation, as you well know, is changing, and likely will be even accelerated in its change under certain proposals that are likely to pass the Congress. And conversion to coal in Texas will create many new sources of sulfur dioxide and sulfates. Research, then, into the current components of the air pollution in Houston and the changes that result with increased coal conversion should not only assist this part of the country in solving new pollution problems, but would, we believe, aid the country generally in the understanding of the air chemistry applicable throughout the Nation.

Further, it seems to us that it's imperative that the new programs mandated by the 1977 Clean Air Act get off to a good start. Because of the complexity of the problem, the vast uncertainties and the tight schedule required to get these programs started, EPA has often based its decision, it seems to us, on limited and unpublished research. Programs that require the expenditure of millions of dollars and affect the health of the public require a substantiated, accredited, factual, scientific foundation understandable to those in our State who deal with these EPA decisions. And the courts of the United States, by repeatedly rejecting EPA decisions as lacking in scientific support, have created the most obvious demand for this factual basis for decisionmaking. One such case was the *Texas* case that we filed over the EPA's transportation control plan and which I personally handled. This plan was remanded to the EPA because of an inadequate scientific basis. Now we do not enjoy having to sue a Federal agency whose goals are the same as ours, but we do demand these regulatory actions be knowledgeable and reflect an understanding of the problem, and be based upon evidence that the regulations will actually result in an improvement of air quality commensurate with the economic and social burdens that they impose.

To insure, also, that regional research programs such as the Houston air pollution study are of a high scientific quality and are creditable and are relevant to the actual problems, there must be an opportunity for participation by local experts and by affected citizens— and we are fortunate here in Houston to have an abundance of such local resources—Rice University, the University of Houston, the medical schools, the NASA facilities, the oxidant research presently being undertaken by the chamber of commerce, the data collected and work done by the fine staff of Dr. McKee and Ken MacKenzie, and the staff and facilities of the Texas Air Control Board, just to name a few. And I would hope that EPA would draw upon all of these resources. I further urge that EPA recognize and use the citizens' committee currently being organized to assist in developing its own research plan. This committee can facilitate the exchange of technical information and can reflect the concerns of the average citizen in the Houston area.

The ultimate purpose of all of this—or any research—is to have the results accepted, first, and then acted upon. Since our hope is that the Texas Air Control Board will adopt regulations on the basis of this research, it is imperative, we believe, that citizens, the board, and local air pollution experts be intimately involved in the research program to insure their confidence—the citizens' confidence—and the community's acceptance of the ultimate result. And I want to stress that the research needed for Houston must be relevant to the immediate problems. We do not seek a laboratory in Houston for fundamental research; instead we seek research into the sources and health effects of the Houston aerosol haze, and the other pollutants that result from chemical reactions in the air. A thorough review of the available information should be, we believe, followed by an assessment of where research money can best be spent to aid in solving the gulf coast pollution problems.

And finally, then, Mr. Chairman, and again with great appreciation for your indulgence, I know you're aware of the longstanding controversy between the State of Texas and the EPA concerning oxidant control strategies, and it's not my intent to reopen this controversy here. However, because of this disagreement, Texas officials have been viewed in some quarters as having less than a total commitment to clean air.

I want to dispel that misconception. And that misconception would be that—if anyone holds it—that we are not totally committed to clean air in this area. The citizens are, the air control board is, the city offices are, the EPA—all of us—our office, the city attorney, the county officials—I think it's fair to say that our record speaks for itself. We've not always been perfect, but we've tried hard. And I'd stack up our efforts against anyone's. I've always believed that the State should lead and not follow progress. And the State should be strongly committed to clean air and clean water. And I assure you that we take a backseat to no one in our concern for this air pollution problem and its health effect, and I assure you ours is not a philosophical dispute as to whether or not we should have that clean air, but a technical dispute as to how it can best be achieved. And your appearance here today gives me hope that we can put this dispute behind us, so that we can get the facts, make a resolution of the best possible program to meet the real problem that exists, clear up the air pollution that we have here, to write a great legacy for the future as far as this important part of the United States is concerned, provide the quality of life that must go with any dynamic city, and go about the business of determining what is causing this problem and then proceeding vigorously to solve it. And I'm so grateful, and I'm sure I speak the concerns of the citizens of this area and of our State for your interest in the matter. Thank you very much, Mr. Chairman.

Mr. Brown. Thank you, Mr. Hill. I want to express my own appreciation for your very sound and wise comments. I don't always feel that brief hearings of this sort make a contribution to the solution of a problem, but I'm inclined to feel that because of the high quality of the witnesses we've had, exemplified by yourself, as well as Senator Bentsen and the various technical experts, that we may actually have made a contribution to getting us on the right track here. And I am grateful to you.

Mr. Hill. Thank you very much.

Mr. Brown. Do you have any questions?

Mr. Hill. I might pay my special respects to our distinguished Congressman, Mr. Bob Eckhardt of this area, and I don't know of anyone in Congress that tried harder through the years to deal with the environmental concerns of our State. I for one appreciate it, and I'm sure that the citizens appreciate it, Mr. Congressman.

Mr. Brown. Well, we're aware of his contribution in Washington, and I said earlier today that our hearing here is due to the persuasive efforts of Mr. Eckhardt, Mr. Gammage, and other members of the Texas delegation and we really hope we can be helpful.

Mr. Hill. Yes, indeed, and Congressman Gammage is likewise following in that tradition of environmental concern and certainly we're all aware of the good work of Mr. Bentsen. So thank you.

Mr. Brown. And with those good words, the subcommittee will be adjourned. We thank the members of the audience for their patience in being with us these last 4 hours.

[The prepared statement of Mr. Hill follows:]

PREPARED STATEMENT OF JOHN L. HILL, ATTORNEY GENERAL OF TEXAS

Mr. Chairman: Having spent considerable time and effort over the past five years on the vexing problem of air pollution here in the Gulf Coast area, and having long voiced my concern for the need for additional research into this problem, it is with special pleasure that I welcome you to Houston and commend you for the interest you have shown in our unique situation.

I was first elected attorney general on a strong environmental platform with a firm pledge to enforce the environmental regulations of this state, particularly here in the Gulf Coast area. This is a pledge that has been kept. Since January 1 of 1973, my office, working with the Texas Air Control Board, has prosecuted over 100 lawsuits in the Houston area alone to abate violations of state and federal air pollution regulations. Over 1½ million dollars have been collected in civil penalties in these cases. In many cases, we worked jointly with the City of Houston, or Harris County and the late Dr. Quebedeaux, to whose efforts we all owe so much. As a result of these State and local efforts, and the significant volutary compliance by local industry, I think I can say with a reasonable degree of certainty that there is not a single major emitter of air pollutants in the Gulf Coast area in violation of State regulations and the State's implementation plan.

These efforts have resulted in tremendous reductions in the amount of contaminants emitted into Houston's air. I don't think there is any doubt that had it not been for these efforts air pollution in this area would be far worse than it is today, and indeed would be among the worst in the world. However, despite these important gains one does not need to be an environmental specialist to realize that we still have a major air pollution problem—one need only live here and breathe the air. Having worked closely with air pollution experts for the last five years, it has become increasingly obvious to me that our air pollution problem transcends the five federal criteria pollutants and the control strategies for those pollutants.

While EPA has, understandably, concentrated its efforts on problems that appeared to be common throughout the nation and has aimed its programs at the handful of pollutants that it believed would have the most significant health effects, other problems have gone unsolved.

Therefore, it is imperative that Congress provide EPA the resources, and that EPA use those resources, so that the next phase of pollution control can be aimed at providing programs that recognize and seek to solve unique regional problems. The new million dollar study for Houston is an excellent first step. A first step, however, is all that the study is. Houston's unique air pollution problem demands more.

As I am sure you are aware, Mr. Chairman, Houston's air pollution does not fit the traditional model for air chemistry developed from the Los Angeles study and studies of other major cities in the country. The combination of a warm climate, high humidity, close proximity to the ocean and the high concentration of petroleum and chemical industries causes this unique situation. As one result the aerosol haze in Houston is not being reduced significantly by current programs. This is particularly disturbing because a large percentage of these aerosols is within the particle size range which seems most likely to cause adverse health effects.

The failure of present Federal programs and the State's programs to which they are tied by law to solve Houston's problem is only part of the reason this committee should be interested in further research for this area of the country. Houston provides a unique opportunity to examine problems associated with new fuel conversion programs. Since Texas has had an abundance of clean burning natural gas the Houston air has not been significantly contaminated with the sulphur compounds common in other areas where coal and oil are burned. This situation is changing, and conversion to coal in Texas will create many new sources of sulphur dioxide and sulphates. Research into the current components of the air pollution in Houston and the changes that result with increased coal conversions should not only assist this part of the country in solving the new pollution problems, but would aid in the understanding of air chemistry applicable throughout the nation.

Further, it is imperative that the new programs mandated by the 1977 Clean Air Act get off to a good start. Because of the complexity of the problem, the vast uncertainties and the tight schedules required to get programs started, EPA has often based its decisions on limited, unpublished research. Programs that require the expenditure of millions of dollars and affect the health of the public, however, require a substantiated, credible, factual foundation, understandable to those who must deal with EPA decisions.

The courts, by repeatedly rejecting EPA decisions lacking scientific support, have created the most obvious demand for such a factual basis for decision. One such case was the State of Texas' lawsuit over EPA's transportation control plan, which I personally handled. This plan was remanded to EPA because of an inadequate scientific basis. We do not enjoy having to sue a federal agency whose goals are the same as ours, but we do demand these regulatory actions be knowledgeable, reflect an understanding of the problem, and be based upon evidence that the regulations will result in an improvement of air quality commensurate with the economic and social burdens they impose.

To ensure that regional research programs, such as the Houston air pollution study, are of high scientific quality, are credible, and are relevant to the actual problem, there must be an opportunity for participation by local experts and affected citizens. We are fortunate to have an abundance of local resources—Rice University and the University of Houston, the medical schools, the NASA facilities, the oxidant research presently being undertaken by the Chamber of Commerce, the data collected and work done by the fine staff of Dr. McKee and Ken MacKenzie, and the staff and facilities of the Texas Air Control Board, to name a few.

I would hope that EPA would draw upon all of these resources. I further urge that EPA recognize and use the citizens committee currently being organized to assist in developing its research plan. This committee can facilitate the exchange of technical information and can reflect the concerns of the citizens in the Houston area. The ultimate purpose of this, or any, research is to have the results acepted and acted upon. Since our hope is that the Texas Air Control Board will adopt regulations on the basis of this research, it is imperative that citizens, the Board and local air pollution experts be intimately involved in the research programs to ensure their confidence in the ultimate result.

I want to stress that the research needed for Houston must be relevant to the immediate problem. We do not seek a laboratory in Houston for fundamental research. Instead we seek research into the sources and health effects of the Houston aerosol haze and the other pollutants that result from chemical reactions in the air. A thorough review of the available information should be followed by an assessment of where research money can best be spent to aid in solving the Gulf Coast pollution problem.

Finally, Mr. Chairman, I know you are aware of the long standing controversy between the State of Texas and EPA concerning oxidant control strategies. It is not my intent to reopen this controversy here. However, because of this disagreement Texas officials have been viewed, in some quarters, as having less than a total commitment to clean air. I would like to dispel this misconception. I take a back seat to no one in concern for air pollution and its health effects; and I know this is true of our state and local air pollution officials. I assure you ours is not a philosophical dispute as to whether or not we should have clean air, but a technical dispute as to how it can best be achieved. Your appearance here today gives me hope that we can put this dispute behind us, so we can go about the business of determining what is causing our air pollution problem and proceeding vigorously to solve it.

STATEMENT PRESENTED TO THE ENVIRONMENT AND
THE ATMOSPHERIC SUBCOMMITTEE OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY
GEORGE E. BROWN OF CALIFORNIA, CHAIRMAN
NOVEMBER 21, 1977

I sincerely appreciate this opportunity to present testimony to the committee on behalf of the Harris County Pollution Control Department. We are vitally concerned with the pollution problems of this area and are looking forward to the proposed air pollution research to be undertaken by the E.P.A. in this area. Other testimony presented to you at this time will outline the research activities which we believe are necessary to define our air pollution problems and ultimately suggest practical control methods.

The E.P.A. is in possession of a list of specific projects which I proposed on October 19 and delivered to Mr. Ray Lozano of the Dallas office. In that statement I proposed that the E.P.A. station in Houston for a period of not less than twelve months a task force composed of its own personnel to conduct research studies related to air pollutants and their health effects. This task force should be empowered with sufficient funds and flexibility to alter the course of their research program as accumulating data dictates.

Further, I stated it is absolutely necessary that a local steering committee be given official recognition to act in an advisory capacity to the E.P.A. research staff. A committee was formed on October 19 and is actively planning to interface with the E.P.A. to the extent allowed. A copy of the committee membership is attached.

Local entities, which have first hand knowledge of our day to day problems, acting in cooperation with the E.P.A., which has the personnel and equipment, can form a team capable of providing answers to our local air pollution problems.

A. R. Peirce
Director
Harris County Pollution Control Dept.

ARP/lb

LIAISON COMMITTEE FORMED ON OCTOBER 19, 1977

Chairman -	Dr. Stanley H. Pier -	University of Texas School of Public Health
	Dallas Evans	City of Houston Air Pollution Control
	Allison R. Peirce	Harris County Pollution Control Department
	Jim Payne	State Texas Air Control Board
	Mary Rollins	Citizens Groups League of Women Voters Citizens Environmental Coalition Citizens Clean Air Advisory Committee
	Larry Feldcamp	Houston Area Oxidant Study
	Dr. Richard Severs	San Jacinto Lung Association
	Unnamed	Harris County Medical Society
Ex officio	Ray Lozano	Federal E.P.A. - Dallas
Ex officio	Robert Rowley	Federal NASA

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LEAGUE OF WOMEN VOTERS OF HOUSTON

TESTIMONY SUBMITTED TO THE U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY

from
Brenda Gehan
President of the League of Women Voters of Houston

Because of our deep concern for the public health of the citizens of Houston, the League of Women Voters of Houston has decided to submit testimony regarding the need for research in the area of air pollution in Houston/Harris County. As a citizen's group that has worked in the field of air quality for many years, the Houston League regularly sends representatives to public hearings, educational conferences and briefings, so that our information on local air quality is kept as current and as complete as possible. We have identified several issues of local significance that we believe should receive attention and thorough research.

We are concerned about preventing the possible development of chronic respiratory and cardiovascular diseases, which may be the result of uncontrollable levels of ozone (O_3). The high levels of O_3 that often exceed the primary national ambient air quality standard (NAAQS) in Houston do not seem to elicit the same physiological responses that a corresponding level does in California. While eye lacrimation and vegetation damage do not seem to occur in Houston, as in California, suggesting that another photochemical oxidant may be responsible for these effects, we recognize that O_3 itself may be damaging to health. Presently, in Houston, O_3 does not appear to be responding to the Los Angeles developed control strategy to prevent its formation. This indicates that there may be some regional differences between the Los Angeles air and the Houston air. We believe that a more appropriate control strategy for O_3 in the Gulf Coast area needs to be developed. In this regard, the data provided by the Houston Area Oxidant Study should be analyzed and built upon. Because the clinical effects study was deleted due to inadequate funding, this needs to be initiated. In addition, the epidemiological studies need to be continued on a long term basis.

We are concerned that the respirable particulates, which are the most damaging to public health are not being measured by present monitoring techniques. We are aware that particulates exceed the primary NAAQS in Houston. Their size and composition need to be adequately determined. Of particular concern is the possibility that they may be carrying carcinogenic substances. Thus improved methods of analyzing and measuring respirables, including aerosols, need to be developed.

Many Houstonians are concerned about the public health implications of fossil fuel conversion due to natural shortages. The large number of industrial facilities in the Houston area make this a potentially widespread problem. The high humidity will hasten the conversion of sulfur dioxide (SO_2) to sulfites and sulfates which researchers seem to be recognizing as being more damaging to health than SO_2 itself. An assessment needs to be made about these health implications.

Another concern is that the possible synergistic action of these pollutants (O_3, particulates/aerosols, and SO_2) with each other, as well as with the complex organic emissions of Houston's petrochemical-refinery industries is not presently bei-g determined. This area needs to be researched.

What may be of the highest priority is the need to determine the relationship between Houston's air pollution constituents and the unusually high cancer mortality rates in our region.

At a meeting in Houston this January at M.D. Anderson and Tumor Institute, Dr. Joseph Fraumeni, chief of environmental epidemiology with the National Cancer Institute (NCI), said that in a survey of U.S. cancer deaths his group found a significantly higher death rate from lung cancer in Southeast Atlantic and Gulf Coast counties, including Harris County (in which Houston is located). He pointed to the petrochemical industry as being one of the common elements in the counties with high incidences of lung cancer.

Relatedly, in a survey of cancer mortality conducted by the NCI in counties where the petroleum industry is most heavily concentrated, NCI epidemiologists observed in the October 7, 1977 issue of Science that:

> "The correlations with lung cancer in the study are a cause for concern because lung cancer occurs excessively among other polycyclic aromatic hydrocarbon exposed groups.....; and the high rates of lung cancer among female residents in the petroleum industry counties raise the possibility of a pollution hazard spreading beyond the workplace."

In conclusion, Houston's needs, and the concentration of its medical and other research facilities make it appear to be an ideal place for the acquisition of new knowledge, by developing appropriate methods and techniques, and by initiating clinical effects and epidemiological studies. In addition, the concentration of petrochemical industries suggests Houston as being an ideal location for initiationg programs to discover a possible environmental/occupational link to increased cancer mortality rates.

TESTIMONY

BEFORE THE SUBCOMMITTE ON THE ENVIRONMENT
AND THE ATMOSPHERE
OF THE U. S. HOUSE OF REPRESENTATIVES
SCIENCE AND TECHNOLOGY COMMITTEE

November 21, 1977

Houston, Texas

Stennie Meadours

Galveston Bay Conservation and Preservation Association

I am representing Galveston Bay Conservation and Preservation Association (GBCPA). Our organization acts as environmental watchdog for Galveston Bay and the La Porte, Shoreacres, Seabrook and Clear Lake area.

At present I am employed as a Naturalist at the Armand Bayou Nature Center. In December of 1977 I will receive a BS degree in Public Affairs, Environmental Management. At this time I am serving a three year term on the Executive Board of the GBCPA, and am a member of the newly formed Citizens Clean Air Advisory Council for the Houston Area. I participated in a consulting capacity in the Bayport Channel Citizens Commission's (BCCC) actions. And most recently testified at the Texas Air Control Board (TACB) - American Hoechst Corporation ajudacative hearing.

GBCPA represents a unique community. The residents, approximately 40,000, are a mix of Black, Brown and White; volunteer, blue collar, white collar and professional. The majority are employed by NASA, University of Houston at Clear Lake City and local industry. The school systems are excellent, where industrial taxes play a key role. Year-round extra-ciricular activities for children abound; scouting, soccer, baseball, football and competative swimming. Many adults give time, love and energy as volunteer coaches and scout leaders. In addition, this particular geographical area offers a diversity of outdoor recreational activities; fishing, shrimping, crabbing, sailing, canoeing, tennis, hiking and birding.

Here exists a high degree of community identity and cohesiveness. It is apparent that the residents value the quality of life they presently enjoy.

Paradoxically, this community is on intimate terms with industry and industrial pollution. It is bounded by Galveston Bay to the East, Bayport Industrial Complex to the West, Texas City Industrial Complex to the South And the Houston Ship Channel and Barbour"s Cut to the North. We see, hear, smell and taste industrial pollution in varying degrees every day of the year. Velsicol, of the recent "Phosvel Zombie" tragedy, is one mile from my home.

As a a naturalist I appreciate the biological diversity that exists here; alligator, bobcat, coyote, deer, osprey, houndreds of shore and migratory birds, the flood plain forest, the coastal prarie, and of course the Gulf Coast. As a mother of three children I appreciate the human diversity represented in my community. I believe my children will be better prepared for adult life as a result of their exposure to people of differing social, economic and racial backgrounds.

I have spent a good deal of your and my time explaining the character of our community. I do this so you will realize the value of what is being threatened.

This hearing is being held by the Committee on Science and Technology Sub-committee on the Environment and the Atmosphere. The majority of testimony, I understand, will address areas where scientific studies and technological advances will, hopefully, improve the environmental quaility of the greater Houston area. The object of this testimony is not to refute the value and necessity of research. Rather, to address areas where, in addition to environmental improvements brought about by research; environmental quality can be enhanced by changes in Texas Air Control Board policy and procedures.

Recent experience with the GBCPA community's attempts to maintain environmental quality has pointed, very clearly, to environmental legislation inconsistancies and the need for changes in TACB's present methods.

To properly define the issues, I will procede as follows: First, a brief overview of the area's past environmental conflicts. Secondly, using actual examples from these activities, delineate the specific inconsistancies and procedural problems encountered. And lastly, to present a proposed solutio

As a common denominator to the following cases: In 1964 during the land acquisition phase of Bayport, residents were assured that there would be no producing plants east of Hwy..146 and for further protection the north bank would be left vacant to act as a buffer zone.

In 1975 Atlantic Richfield Company applied for a permit from the Corps of Armay Engineers to construct an off-dock loading facility on the north bank of the Bayport channel. This facility would be capable of handling 2 million barrels of crude oil a day; it would accommodate the VLC tanker, 150,000 dead weight tons, (the VLCs are so large that for them to navigate the Houston ship-channel one-way traffic would be required) and this facility was to be located approximately 125 feet from established homes. Previous to permit issuance at a public hearing and by letter the community voiced its opposition. The Corps stated that an Environmental Impact Statement (EIS) was not required and issued the permit. The BCCC was formed, then filed suits against the Corps on the grounds that an EIS was required. After Judge Bue ordered an EIS the permit application was essentially dropped. No further actions were taken by the Corps or ARCO. This process cost the citizens approximately $17,000.00 in legal fees.

In July of 1977 Texas Cir Control Board issued a permit to construct to American Hoechst Corporation, a German based firm. The facility was to be located on the east side of Hwy. 146 between the communities of Shoreacres, Bay Colony and El Jardin. The proposed plant utilized benzene, a known carcinogen, to produce styrene monomer, a known odor pollutant. It was to be located such that the residential areas were directly downwind from the prevailing air flow. The permit application showed the plant to have unusually high pollution control technology with only 74 tons of emissions per year.

The affected residents work in the petrochemical industry, they know how pollution abatement devices and TACB permits work on the day to day reality basis. Area citizens also know that no matter how good a permit looks on paper they can be 100% sure that the plant will have more emissions then stated on the permit. The community became alarmed; the GBCPA appealed the permit.

Again the citizens bore the cost of lawyer fees. This time for a TACB adjucative hearing. A hearing that pitted lay citizens against a state agency, TACB defending their previously issued permit, and American Hoechst a 9½ billion dollar foreign firm.

At present the American Hoechst hearing is in the process of a Texas Air Control Board review and decision. The American Hoechst hearing was the first ajudacative hearing held by the air board. Following are the policy and procedural problems which became apparant.

1. TACB rules and regulation preclude public input and participation. The air board does not provide any form of public notice of either permit applications, or of permitting actions taken by the board. Bay area residents learned of the permit via a newspaper article on the American Hoechst land

option. Harold Scarlett, the Houston Post Environmental Writer, after attending several sessions of the hearing captures the essence of the situation in his featured column.

> "Three years ago, after a similar lack of public notice in a Spring Branch case, the air board pledged to hold public hearings in all future cases involving potentially controversial permits.
>
> Yet, incredibly, the air board even now still has no machinery for notifying citizens of the new industrial projects that could affect their neighborhoods.
>
> The agency, in fact, has moved in the opposite direction, toward even less communication with the public.
>
> Last February, pleading excessive expense, the air board stopped sending mail notices to interested citizens and groups who had requested them.
>
> It said interested persons could hence-forth find such information published in the new Texas Register (subscription price:$25.00 a year)."
>
> "But, it turned out, the air board does not publish construction permit applications in the Register."
>
> "Air board permit applications appear only (and there in skeleton form) in the Texas Pollution Rep ort, a private Austin publication that costs $50.00 a year. Even there, the permit listing was instigated by the publication not the air board."
>
> "As of today, the air board still does not advise the public in any way-not even in a newspaper legal notice -- of even major industrial projects such as the Hoechst plant."

The TACB public notice and hearing policies are in direct contrast to those of Texas Water Resources:

When a citizen or a group requests, they are placed on the TWR mailing list. Then then receive notices of all public hearings; the time, place and the pertinent permit application information. The TWR holds a public hearing for all permit applications. In addition, TWR gives timely notice; two months to six weeks in advance of the hearing.

At TWR public hearings all interested parties may speak with no prior notification to the TWR. To contrast TACB ajudacative hearings a summary of TACB procedural rule 54.6 follows.

Citizens wishing to be hard must notify the TACB by a certain date, then a prehearing conference, where the issues are defined, is held. At the prehearing conference the parties are required to: present a list of witnesses, and a brief summary of their prospective testimony, present a written statement of the disputed issues, present a copy of written statements and all other written testimony or evidence the party intends to use at the hearing. The hearing examiner at the prehearing conference has complete authority over what may be submitted as evidence and what issues are revelant.

I returned from a Thanksgiving trip late Sunday night Nov. 27, 1977. I checked my mail on return from work Monday the 8th. As a member of CCAAC I regularly receive packets with information of TACB recent activities. On the 8th such a packet, post marked Nov. 23, was in my mail. This packet contained a notice of a permit application hearing set Dec. 19, 1977. The subject of the hearing was a B. F. Goodrich permit to construct on a site east of Hwy. 146 in the Bayport complex. The notice stated, "No person shall be admitted a party unless the request is received at the address shown above by November 28, 1977. At the hearing, only those persons admitted as parties will be permitted to present evidence and argument and to crossexamine witnesses. The timing of this notification precluded my participation as a concerned citizen and as a member of the CCAAC.

TACB is also out of phase with the Corps public notice procedure. The Corps maintains a notification list. When your name is placed on the list, you receive a copy of a detailed description and location of the proposed project. The Corps holds public hearings when public response to a particular permit demonstrates a need.

Even if given timely notice, the citizen has another obstacle in his efforts to have some input in TACB permit decisions. It is almost impossible for the lay citizen to effectively manuever through the legal maise required by an ajudacative hearing. If this is accomplished, and if other hearings are anything like the American Hoectsh hearing, the company lawyer's legal skill and experience could easily devistate citizen parties. Thus to be e effectively represented TACB ajudacative hearings require legal council for the citizen.

Neither TWR or the Corps require legal council for the lay citizen to effectively participate at a hearing.

2. TACB citizen response time. Permit application information is difficult and sometimes impossible to get.

On Nov. 8, 1977 a request for permit application information on the Goodrich plant was made by GBCPA. The TACB wrote backs and said that the request would be forwarded to the permit applicant's (B. F. Goodrich) lawyer and he would forward the information. About two weeks later a letter was sent to the GBCPA stating that to avoid confusion all future request should be made the the TACB lawyer. Finally on Nov. 25, 1977 the information was received. It was packaged so badly that the postman had to put rubber bands around it to keep it together, it is a wonder that the post office delivered it at all.

When GBCPA requested information on the American Hoechst permit a three week delay ensued, then only a portion of the permit information was made available. This three week delay was in a period of preparation for the ajudacative hearing, where only permit issues can be discussed.

Understandably the above two incidences, the only occasions GBCPA has had to request permit application information, have added to citizen frustration and in fact has limited participation.

Possibly the reason is as Harold Scarlett mentions, TACB has no internal machinery for this function. What ever the reason, in reality these actions widen the gap in TACB and citizen trust. An area of extreme distrust has been created by present TACB policies and procedures. This distrust makes environmental issues more difficult and expensive to resolve.

3. TACB designates land use but does not consider land-use impacts. Texas law requires a TACB permit to construct be granted first before any other permits may be obtained. In fact, financing and land options are held until the construction permit is issued. It cannot be denied that social, economic and environmental impacts will accompany the new facility and its resulting activities, thus affecting the surrounding area.

During the course of the Hoectah hearing TACB lawyer and staff members maintained that only air emissions impacts to surrounding area could be considered in construction permits.

Following are excerpts from the Texas Clean Air Act. I propose that the TCAA does not preclude, but rather includes, land use considerations in the decision to issue a construction permit.

"Policy and purpose"

> "Section 1.02. It is the policy of this state and the purpose of this Act to safeguard the ari resources of the state from pollution by controlling or abating air pollution and emissions of air contaminants, consistent with the protection of health, general welfare, and the physical property of the people, including the esthetic enjoyment of the air resources by the people and the maintenance of adeauate visibility."

"Factors to be considered"

> "Section 3.13. In making orders and determinations, the board shall consider all of the facts and circumstances bearing upon the reasonableness of any emissions being made, including:
> "(1) the character and degree of injury to, or interference with, the health and physical property of the people;
> "(2) the social and economic value of the source;
> "(3) the question of priority of location in the area involved; and
> "(4) the technical practicability and economic reasonableness of reducing or eliminating the emissions resulting from the source."

"Construction Permit"

> "(c) If, from the information submitted under subsection (b) of this section, the board finds no indication that the proposed facility will contravene the intent of the Texas Clean Air Act, including proper consideration of land use, the board shall grant within a reasonable time a permit to construct.....or the proposed facility."

The Clean Air Act of 1977 amends "Implementation Plans," section 110(a) (2) (B).of the Federal Clean Air Act of 1970. In a TACB staff summary report of the Clean Air Act of 1977, they interpret;

"Land Use

> The phrase "land-use" is deleted from section 110(a) (2) (B) of the act, which sets out requirements for State implementation plans. The words "air quality maintenance plans, and preconstruction review of direct sources of air pollution" are substituted. Preconstruction reviews of direct sources are to include consideration of energy, environmental and economic impacts. The only land-use regulations which may result from implementation of this act are those which are needed to assure attainmant and maintenance of ambient air quality standards and prevent significant deterioration of air quality."

I interpret this to mean TACB may not issue land use regualtions unless it is required to "assure....attainment....prevent significant deterioration of air quality".

Further, preconstruction reviews are defined as considerations of energy, environment and economic impacts. I read the amendment to formalize the considerations of land-use impacts into preconstruction reviews. The preconstruction reviews make considerations of energy, environmental and economic impacts a legal requirement in the State implementation plans.

In the determination to issue a permit to construct, even when the resulting facility is setting a precedent in land-use, or when there is conflicting land use, i.e. constructing a facility that utilizes large quantities of highly toxic benzene in a coastal natural hazzard area where subsidence, faulting and hurricanes are common, the TACB maintains that they cannot legally consider impacts other than air in their decision making.

This is indeed arbitrary and capricious decision making; diametrically opposed to the spirit and intent of the Clean Air Act of 1977 and the National Environmental Policy Act of 1969.

In Texas, the task of environmental considerations and reasonable land use seems to have fallen to the citizen. He performs this job by the costly process of litigation; this is in addition to his normal tax burden.

4. Comprehensiveness and credibility of TACB permit evaluation data.

Within the next 30 days EPA will decide if Texas will receive a waiver to the new off-set policy. In the near future industrial plants may be required to switch to an alternate fuel, possibly coal. The American Hoectah permit did not list an alternate fuel as such; it listed another grade of the same fuel, A company official testified that American Hoechst had unlimited access to fuel oil #2 and #6. He further testified that the plant, as designed in this permit, could not operate with coal as a fuel, (this does not preclude the possibility of plant modification; this could not be discussed, however, because according to TACB rules only information pertaining to this permit could be addressed).

A permit to construct was granted based on the use of fuel oil #2 and #6 only. Once the plant would be operating, and the switch to coal required, it becomes an economic matter to rationalize the resulting pollution.

With off-set and alternate fuel policy decisions pending should not consideration be given to future possible air emissions when TACB evaluates an application for a permit to construct.

Recently in the Corpus Christi Petrochemical Plant case, EPA invalidated a TACB permit to construct because TACB did not consider fugitive emissions. The American Hoechst permit is similar. An American Hoectsh official testified under oath that there would be no fugitive emissions. No consideration of fugitive emissions were given in the permit. It is truly hard to conceive of an industrial plant without fugitive emissions. TACB publically accepted the assertion that there would be no fugitive emissions in either of American Hoectsh's ethlbenzene styrene monomer plant and the high density polyethlene plant.

For permit evaluation TACB requires modeling of air emissions. The model presented by American Hoectsh and accepted by TACB was predicated on questionable data. Inacurracies in prevailing wind direction and participation rates were brought out by citizen testimony. These inaccuracies partially invalidate the results of the modeling, yet; a permit has been issued utilizing this data.

Included in the air quality assessment, prepared by a private environmental firm, was additional data concerning fugitive dust emissions. This data accompanying the American Hoechst permit application was accepted as credible by TACB. This study compared the level of fugitive dust emissions of the undeveloped site with fugitive emissions after the proposed facility is completed.

The fugitive dust emissions study states that a simplified version of a certain equations is used, but it does not give the simplified version. The study also, did not state which factor was used for the different parameters, i. e. I= soil erodibility, K= surface roughness, C= climatic factor, and L'= unsheltered field factor. The modeling was based on the site soil being

being sandy loam with 50% vegetation coverage.

The outcome of the air modeling is stated in the study.

> "Employing these assumptions, the model yields a total particulate emission of 69.3 tons/year for the undeveloped site and 29.3 tons/year for the site after the proposed chemical plant is completed. This latter value employs the assumptions that the barren surface within the chemical plant boundaries is treated with stabilizing chemicals. The construction of the chemical plant would therefore reduce fugitive particulate emissions of the site by 40. tons/year (43 percent of present emissions)."

A quick check in the Soil Survey of Harris County, Texas, United States Department of Agriculture Soil Conservation Service, shows the soil to be Beaumount clay, not sandy loam. A comprehensive personal inspection of the site showed it to be denly covered (96% -100%) in coastal prarie grasses. The basic assumptions having been proven erronous completely invalidates the study.

The question must be asked, why would such inaccurate, biased data be presented and then accepted by TACB.

The reports conclusion, even if it were accurate, that American Hoectsh will reduce pollution by chemical plant construction, denuding the remaining site and applying chemicals is an insult to the intelligence of even my 12 year old.

In conclusion, if we add the "fugitive emissions reduced by construction" (29.3 tons/year) to those produced by plant operation (73.6 tons/year) the result is 103.2 tons/year. This would push the American Hoectsh plant into the major source catagory.

In the above I have pointed out the areas where Texas citizens have met with frustration and confusion in their attemps to have an accounting for environmental quality in their community. A large part of the confusion and frustration is due to the fact that TACB, a state environment agency, supported by tax dollars, does not offer affected citizens; the courtesy of notice, an opportunity to offer input, nor the assurance of accountability.

The solutions we propose are not new, but have proven effective by Texas Water Resources and the Army Corps of Engineers.

To insure proper notice, opportunity of input and to provide pertinent information for affected citizens the CBCPA strongly urges TACB to promulgate public notice rules and regulations.

These public notice rules and regulations, if promulgated, would foster trust between citizens and TACB and would validate full representation of citizen, government and industry. In such a dynamic and resource rich state, such as Texas; it is almost incredible that the machinery for a public notice and response process does not already exist.

Secondly, in order that acknowledgement and considerations be given to the full implications of a permit to construct, to insure proper land-use considerations, and to have comprehensive accurate and pertinent data used in permit evaluation, GBCPA propose that legislation be passed, or TACB interpret the TCAA, requiring an Environmental Impact Statement when, land-use permitted by a permit to construct is precedent setting or when the results of a permit to construct would significantly affect the human environment.

California and North Carolina are two states that require EIS's; surely Texas resources, land-use, citizen health, welfare, property , environmental quality and economy are as valuable as Claifornia's and North Carolinia's.

If we are to learn how to control air pollution, research must continue, however, its value will be diminished unless adequate environmental considerations are made on the implementation level of government. As the Texas Clean Air is presently interpreted, the issues of TACB public notice and participation, citizen response, land-use designation without considerations and comprehensive and credible permit evaluation data, provided serious loopholes in the implementation of TCAA. If these loopholes are not closed citizens , government and industry will continue to lose money, time , resources and environmental quality.

The National Environmental Policy Act of 1969 requires balancing of economic and environmental issues. Our life support system, the biosphere is based on the balance of environmental and biological factors. Is it not reasonable that the State of Texas provide a means to intelligently balance industrial development and human habitat?

The GBCPA community is involved and caring, however, there will be a point, (possibly the proximity of one more industrial palnt), where each individual will decide that this their present home is no longer safe. This is a threshold decision, based on the value each person places on environmental quality. Some of our neighbors have reached that threshold.

The destruction of human habitat is the ultimate threat of industrial encroachment, this is what we fear. Our community is precious to us.

Respectfully submitted,

Stennie Meadours

Stennie Meadours, Spokesman GBCPA

Applied Meteorology inc

STATEMENT FOR THE HEARING OF
THE ENVIRONMENT AND ATMOSPHERE SUBCOMMITTEE
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

By

John W. Hathorn, Vice President
APPLIED METEOROLOGY, INCORPORATED
9000 Southwest Freeway
Suite 111
Houston, Texas 77074
December 1, 1977

SUBJECT:

- RECOMMENDATION -
  -To Study Synoptic Weather Pattern's Influence on Ozone Episodes-
- PHOTOCHEMICAL OXIDANTS STUDY IN GULF COAST AREA
- ENVIRONMENT AND ATMOSPHERE SUBCOMMITTEE OF U.S. HOUSE OF REPRESENTATIVES

My name is John Wesley Hathorn, and I am submitting this statement in my capacities both as a professional consulting meteorologist for Applied Meteorology, Incorporated, and as an interested and concerned private citizen of Houston, Texas. Since the opinions that I now hold are based on information accumulated over several years of experience, I will begin by discussing my credentials. After this brief resume, I will summarize the characteristics associated with ozone episodes in the eastern United States. Next, I will enumerate several facts concerning the photochemical oxidants problem in Houston and the eastern United States. I will then conclude my statement by recommending an area of study that has received little attention but which I feel has a high probability of explaining both the high frequency of ozone episodes in the eastern United States, and why the Hydrocarbon Control Strategy is not reducing photochemical oxidant concentrations there.

My credentials are as follows:

1. I have a bachelor of science and a master of science degree in meteorology from Florida State University.
2. In 1963 and 1964, while at Florida State University, I worked in the Upper Atmospheric Laboratory where weekly ozone soundings from the ground-level into the stratosphere were made.
3. Since graduation, I have accumulated fourteen years of experience in meteorological analysis and atmospheric chemistry (including instrumentation and monitoring, field diffusion/tracer studies, airborne sampling, computer modeling and diffusion analyses, and overall environmental program design and management). This experience was obtained as a meteorologist and weather forecaster for the

U.S. Weather Bureau, as a research meteorologist for the Boeing Company (on the Saturn V/Apollo Program), and as a consulting meteorologist (for AMI and another environmental consulting company) in Atlanta, Chicago, and Houston.

4. I have experience in analyzing and forecasting the weather phenomenon in the eastern United States since I grew up in Baton Rouge, Louisiana, was a meteorologist at the National Weather Stations in Port Arthur/Beaumont, Texas; Memphis, Tennessee; and Huntsville, Alabama. Also, I was formally taught "current synoptic weather" at Florida State University, Tallahassee, Florida.
5. I assisted the Houston Area Oxidants Study (HAOS) in designing their program and wrote the HAOS Program Description (referred to as the "Blue Book").
6. I have published a paper at the International Conference on Photochemical Oxidant Pollution and Its Control (Hathorn & Walker, 1977). This paper described (1) an analyses of an ozone episode which I personally prepared (based upon data supplied by Monsanto Chemical) and (2) a postulation of "ozone enhancement" by Dr. Harry Walker (Monsanto Chemical).

I recognize that there are many excellent meteorologists who have advised the EPA on the meteorological aspects of the photochemical oxidants problem; however, because I have worked in an operational weather station on the Gulf Coast (i.e., Port Arthur/Beaumont, Texas), I have an appreciation for a little understood, but routinely occurring, weather phenomenon:

> the dissipation of the cold front's structure after it has pushed out over the warm waters of the Gulf of Mexico.

Understanding this phenomenon is basic to understanding the cause of ozone episodes in the eastern United States.

I would now like to list some of the typical characteristics for regional ozone episodes as follows:

1. High ozone concentrations will persist for several days.
2. Both rural and urban air quality monitoring (AQM) stations throughout a large region, whether upwind or downwind of urban or industrial areas, will experience the episode.
3. Concentrations of other contaminants will not necessarily be high at the same time that the ozone concentrations are high.
4. Ozone concentrations rise sharply after sunrise and decrease after dark.
5. Usually the wind is from the southern quadrant and there is a large subtropical anticyclone (in other words, high pressure area) located east to northeast of the region experiencing the episode. (This is referred to as "being in on the backside of a high.")
6. The frequency of occurrences is large (e.g., in Texas, more than three times in some months).
7. These episodes occur so routinely in the eastern United States that

EPA has suggested to all eastern states that they categorize their entire state as a non-attainment area for photochemical oxidants (unless they have monitoring data to prove otherwise).

8. Typically the air in an ozone episode in the eastern United States is not necessarily classified as "stagnant" but does have motion and is characterized by some mixing.

There are several facts about the photochemical oxidants problem that are routinely seen in publications by EPA and other researchers:

1. Because of the data available, EPA has instructed all states in the eastern United States to consider all areas of their state as non-attainment areas for photochemical oxidants (unless there is data to prove otherwise).
2. Even though the Hydrocarbon Control Strategy has been applied in the Houston area, ozone episodes are just as severe and just as frequent as before hydrocarbon emission reductions were implemented.
3. Estimates of the contribution to ground-level ozone concentrations from the stratospheric source range from 25-33 ppb (Mohnen, 1976) on an annual average.

Some additional facts that are necessary to understanding weather in the eastern United States are:

4. Cold fronts (polar outbreaks) push down across the Great Plains into the south and out into the Gulf of Mexico.
5. The waters in the Gulf of Mexico are typically warmer than the air behind a cold front.
6. As cold air pushes out over the warm waters of the Gulf of Mexico, it begins to warm with time. The longer the air travels over the warm water, the warmer the air gets.
7. Since the cold front weather patterns typically move eastward, and the cold front is followed by a high pressure area on the surface of the earth, there is a trailing edge of the cold air which, because it is not associated with any severe weather, has received very little attention in the literature. (See Figure 1)

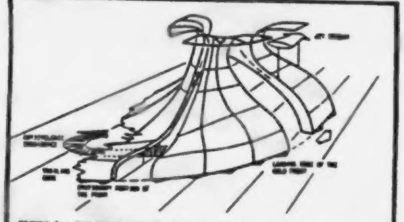

FIGURE 1 - THE THREE-DIMENSIONAL STRUCTURE OF A COLD FRONT. Grid lines on the frontal surface are broken to show the thickness of the frontal layer near the leading and trailing edges. The dissipation of the frontal layer near the trailing edge that begins to occur once the front pushes out over the warm Gulf of Mexico is also shown.

8. The cold front's trailing edge may dissipate near the surface when it has pushed out over the warm Gulf waters. This dissipation will allow any air (or pollutant) trapped within the frontal zone (or layer) to mix to the surface.

Other facts that have been observed, but are not so frequently cited in literature, are:

9. Stratospheric ozone has been observed in the frontal layer in the mid and upper troposphere.
10. Frequently, during air pollution episodes for other contaminants (such as sulfur dioxide) where a trapping inversion is overlaying an area, high ozone concentrations have been measured within the trapping inversion.
11. The air within the trapping inversion can be directly identified as being an old cold front that has previously pushed through the area.
12. The occurrence of ozone episodes in the eastern United States can be shown to be closely linked to the frequency of weather patterns (cold fronts and associated Highs) as they move through the area.

By this straightforward listing of known or demonstratable facts, you probably have already seen the explanation:

> "Because we can demonstrate that there is ozone (whose source was stratospheric) trapped within the frontal layers and because this frontal layer will probably dissipate out over the warm Gulf waters, the areas where the "trailing edge" (but now dissipated edge) of the cold front would have touched the ground will frequently experience ozone episodes."

This area begins around Houston and "moves" northeastward across the eastern United States as the cold front and associated high pressure area move eastward across the United States. (The geographical pattern implied in this description conforms closely to "stratospheric" radioisotope fallout patterns published by Reiter, 1977.)

The remaining question is: "How much ozone can be contributed in this manner?" Two techniques can be used to estimate this amount (however, an airborne sampling program specifically planned to measure it would be most accurate):

1. Note the increase in rural ozone concentrations located up or crosswind from urban sources during regional episode situations. Typically, these increases are 50 to 100 ppb.
2. Convert the "estimates of stratospheric ozone's annual average contribution (e.g., 25 to 33 ppb)" to a "batch" injection occurring only about three times per month (for a two-day period).

   -To illustrate: Even though a man's take-home pay may be $5/hr, the payrole clerk does not drop by his desk each hour to give him a $5 bill. Rather, he is paid in a two week "batch" of $400.

   A "batch" injection of stratospheric ozone one fifth of the time would range from 125 to 165 ppb - easily enough to be the cause of episodes and explaining why hydrocarbon control on urban sources have not reduced the frequency or severity of episodes.

The theory that I offer explains why:

1. Ozone episodes simultaneously occur state(s) wide.
2. Why they are predominantly in the eastern United States.
3. Why they follow high pressure areas and typically have southerly winds.
4. Why the radioisotope fallout patterns measured across the eastern United States occurred as they did.
5. Why a hydrocarbon control strategy will not appreciably reduce the frequency or severity of the ozone episode conditions but may be implemental in reducing the average background level in an area particularly as it occurs down the prevailing winds of a large urban source area.

In summary, I would like to encourage the Environment and Atmosphere Subcommittee to allocate some of their funds for a detailed study of stratospheric ozone intrusion. Presently, EPA has ongoing studies to examine the urban plume downwind of the large urban areas. The Houston Area Oxidants Study has numerous projects to measure the many varied precursors and individual constituants in photochemical oxidants (ozone, PAN, total oxidants, etc.). However, with their limited funds, neither are attempting to specifically analyze the stratospheric ozone intrusion.

I, therefore, strongly urge this Subcommittee to implement, as a portion of their total program package, a study which would examine this phenomenon that is presently not being examined by either EPA, HAOS, nor any other program which we are aware. I feel that this area of study not only offers a greater than 50% probability of explaining the major contributing factor to why ozone episodes occur in the eastern United States, but also offers additional trajectory and analytical results pertinent to other areas of environmental interest, namely:

1. The fluorcarbon/aerosol spray issue,
2. The future impact of supersonic transport in depleting the stratosphere ozone layer, and
3. The civil defense aspects of fallout patterns in the United States.

I would be pleased to answer any questions at this time or participate in a further, more detailed presentation of the information and support in the theory which we are presenting today. If I can be of any help, I can be contacted either by phone at (713) 777-0106, or

Applied Meteorology, Incorporated, 9000 Southwest Freeway,
Suite 111, Houston, Texas 77074.

I thank you for this opportunity to include this on the public record, and will make myself available to answer any questions concerning the information that I have included herein.

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APPENDIX B

CONGRESSIONAL HEARINGS

1979 AUTHORIZATION FOR THE OFFICE OF RESEARCH AND DEVELOPMENT, ENVIRONMENTAL PROTECTION AGENCY

1979 AUTHORIZATION FOR THE OFFICE OF RESEARCH AND DEVELOPMENT, ENVIRONMENTAL PROTECTION AGENCY

HEARINGS
BEFORE THE
SUBCOMMITTEE ON THE
ENVIRONMENT AND THE ATMOSPHERE
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-FIFTH CONGRESS
SECOND SESSION

FEBRUARY 7, 8, AND 9, 1978

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STATEMENT OF LARRY FELDCAMP, CHAIRMAN, HOUSTON AREA OXIDANT STUDY STEERING COMMITTEE, HOUSTON CHAMBER OF COMMERCE, HOUSTON

Mr. FELDCAMP. Mr. Chairman, as I represented earlier, I am standing in today for Dr. Stanley Pier who is chairman of our Gulf Coast Air Pollution Research Committee. Dr. Pier could not be here at the last moment.

Mr. BROWN. Well, without objection the full text of Dr. Pier's statement will be put in the record and you may proceed as you see fit to amplify or abstract from it.

Mr. FELDCAMP. I am going to try to summarize in view of the time, and I think I would like to use the approach of what I would describe as the elements of an effective cooperative research program which is what we are involved with now in the Houston Gulf Coast area, and relate to these elements what we have experienced so far since last October.

I think one necessary element is the interest and willingness of all those groups to work together and with the EPA officials. I think we have such a situation in Houston. We have now on our Gulf Coast Committee 14 members that come from various groups. We have about four from environmental groups, about four from business and industry. You have the city, the county, the State representatives, the medical society, the university.

We also have an overall interest in the area in doing something about the problems. I think, as you know, from the hearing in Houston on November 21, that the Houston Area Oxidant Study, which was initiated by the private sector, is such an effort to gain more information on the air pollution problems.

The second element I think necessary is the involvment of the local groups to identify the local problems and help to define the scope of the research program. This was done initially in our situation at the October meeting with EPA officials during which the committee was initially formed. One thing that we helped direct the EPA to was the needs assessment project—to define what kind of problems we have what the health effects are, and what should be looked at. And I think until we brought this into focus with the EPA the EPA may have been going in a different direction based upon what they had seen in the statute and the legislative history.

The third element I think, even after the initial identification, is the continued involvement of local groups in the development and execution of the research program so that eventually you will end up reaching a mutual solution of the problem and acceptance of the necessary controls by all affected groups.

I think once all groups are involved in the full program, they will have some input. And I do not think you have such a diverse interest that we cannot work together. We have not seen the result so far. It has been a unanimous viewpoint so far which we have seen from our committee. We had another meeting in December with EPA officials to generally outline the program. We then commented as to certain elements of the program that were being left out. That has helped to some extent and we still have not seen the program as defined by EPA in their request for proposals to contractors, the type of program we would like to see. I think eventually we may be able to work that out, but I think that both groups are in a learning process in dealing with this type of program. But hopefully EPA will listen to the viewpoints of the local groups.

Mr. **Brown.** Mr. Feldcamp, if I may interrupt at that point.

One of the earlier witnesses today, I will have to look at the record to refresh my memory, spoke specifically to the oxidant problem as one of the areas on which there should not be an extension of standards which have been set.

Mr. **Feldcamp.** I think that was Dr. Key, who mentioned that, and this is really the problem that we are looking at in Houston on the oxidant problem. And we do not think the Los Angeles situation may be as applicable to ours, and we think that that is really one area of focus.

In the Houston area right now is the oxidant and ozone problem which is related to hydrocarbons. The other problem is particulates and aerosols. We have haze which is composed of aerosols and fine particulates—I think these have not been addressed in the standards at this point—and are there health effects from these? And we think both of these should be looked at. Right now we do not see nitrogen oxides, carbon monoxides, or the sulfur oxides as problems. That is a thing that is coming because we are getting into the fuel conversions. This was mentioned in some previous testimony.

It seems we have a situation of defining a baseline with the monitoring now going on and then seeing the fuel conversions taking place and determining what are the effects.

As a further element, I am not sure what exactly is the solution, but we on the committee feel that there should be some kind of official recognition given to a group such as ours and I would like to quote from Dr. Pier's statement on that because I think he summarizes this and his statement has been approved by the entire committee:

> The committee maintains that it has a most important mission in providin informed, expert local viewpoints to EPA in the pursuit of this phase of the research. However, at this point, the committee is an informal aggregation of interested parties lacking any official status or recognition. As was pointed out in the November hearing in Houston, the functioning of the committee would be improved by such sanction. We don't ask to be loved—only listened to. We have had official statements of endorsement and support from local and State agencies, but it is the Federal recognition that counts.

And an additional thing that Dr. Pier has in his statement which I think is more important, especially to the environmental groups or other citizen groups who are involved, is the matter of financing:

> It has also become clear that the functioning of the committee in the manner intended by the legislation would be materially aided by some funds to support contact with EPA and research contractors. As of now, contracts with EPA can only be accomplished with funds which entail sacrifice to other activities or which may not be available at all.
>
> This is a serious impediment if we are to aid EPA in research planning and implementation, especially at this very early phase of a critical program. I would therefore suggest, speaking for the committee, that a small portion of the budget, or supplementary funds, be provided to support limited travel by committee members. We do not ask for any compensation, only reimbursement for transportation and reasonable living expenses. Such funding would also enable the committee to initiate actions rather than merely being responsive to requests from EPA.

Let me mention a couple more elements, and then I will conclude. I think that we have in Houston an oxidant problem, although we think we differ from Los Angeles and maybe more reflect the problem in other areas. And I guess any type of program where we go into some type of funding should be in relation to the national problem in the sense that there would be funding for that. And if there is such a situation where it may have a national impact, then I think the funding should be sufficient to see to the completion of that program, and I think this was indicated by some of the previous speakers referring to "steadiness of purpose," I think was the phrase used by one; that is, we see to the completion of it. Although I think that there has been talk of $3 million for a study over a 3-year period, this initial needs assessment study may be indicative of what we need to have in the long run. It seems like we ought to see the study to completion instead of doing it partially and still leave further confusion or uncertainty as to what is required.

That sums up my points on the necessary elements and some of our experience.

Mr. Brown. Thank you very much, Mr. Feldcamp.

I think that your comments and Dr. Pier's statement are extremely helpful to the committee.

I might say that as far as I am personally concerned, I am very much interested in using the Houston situation as a prototype of new institutional arrangements involving the local community, local industry, and local health people in all of which areas there are outstanding resources. I am as much interested in developing new methods for bringing about mutual and cooperative involvement of these groups as I am in the technical details of the air pollution problem.

Mr. Feldcamp. We are going through some of that right now trying to work that out.

Mr. Brown. I think it would be extremely useful if we could structure something which would by virtue of its success be applied creatively in other areas involving resources or whatever type it might be.

Dr. Pier indicated a need for a prototype monitoring system, and I can assure you that I will certainly want to look supportively at the need for the additional money. That is always a very sticky problem around here but with the continued support of perhaps this delegation I think we might have a chance to do something like that.

Dr. Byerly?

Dr. **Byerly**. Mr. Feldcamp, you are the chairman of the coordinating committee for the Chamber of Commerce?

Mr. **Feldcamp**. Chairman of the steering committee.

Dr. **Byerly**. Right. And you have expressed an interest in getting yourself involved in the planning of the EPA research program. Would the Chamber of Commerce make a reciprocal sort of offer and really make a cooperative——

Mr. **Feldcamp**. We did not initially when we were trying to get the study underway because at first we did not know whether we could pull that off and get enough funds. We had to go out and solicit the funds first and got over 200 contributors. Once we got it underway or shortly thereafter we contacted the EPA to get their viewpoints on certain of our projects and programs, and we did get, I think, cooperation. I guess the EPA questioned a little bit—are these people for real—initially, but I think this disappeared after we sat down and explained to them we were really serious and objective in what we were trying to do. And we did get some input from EPA people in most areas but with one exception, the health effects. We did not get—I would say and I think most of our people would say—the full cooperation there. We would have liked to really had more. Because more of our people involved are more of the chemists and engineer types, not so much the health effects types where EPA has the expertise. I think we are hopeful of getting more EPA involvement in the present study and with the Gulf Coast Committee that we have had. We have tried to keep EPA advised of what we were doing and considered any EPA inputs in redefining the scope of our projects.

Dr. **Byerly**. So you do feel that you are open for EPA participation in planning your side?

Mr. **Feldcamp**. Yes, for all the planning work, though right now we are into the evaluation.

Dr. **Byerly**. I realize that. Some is behind you, but in future efforts?

Mr. **Feldcamp**. Yes, and I do not know where we are going to go. As I said we are going to finish our $1.4 million program and get something out before we go back to contributers and ask for more money.

Mr. **Brown**. Mr. Feldcamp, I am not really up to speed on all the elements of the study down there, but may I ask if there is any intent as far as you know to include some analysis of the environmental impact of the rapid conversion from oil and natural gas to coal-burning electric generating plants? Might you have to rely heavily on lignite resources of the area?

Mr. **Feldcamp**. Our oxidant study does not include any plans of that sort other than measurements of the levels of sulfates or sulfur oxides present in the air. This could be something that could come out of the EPA study or at least to find a baseline of what is the situation, for we are just now on the threshold of starting to convert.

People are having their gas supplies curtailed or they are going t have to convert pursuant to Federal requirements. So far it has not we have not got into that area.

Mr. **Brown**. It seems to me that that is one of the more striking examples throughout the Nation of potential environmental change of a fairly massive nature based upon the requirements of the conversion of energy sources.

Mr. **Feldcamp**. Yes, I think we are probably more gas-dependent now than probably any other major locale in the country and many of us are concerned about that, but there have been no studies initiated on that at this time.

Mr. **Brown**. Well, maybe we could use that to justify a continuation of the funding over a little longer period of time.

I want to thank you very much for your testimony and we will not keep you any longer at this time. If we need to get in touch with you we will communicate in writing.

Mr. **Feldcamp**. Thank you.

[The prepared statement of Dr. Stanley M. Pier follows:]

STATEMENT OF
DR. STANLEY M. PIER, CHAIRMAN
GULF COAST AIR POLLUTION RESEARCH COMMITTEE

Mr. Chairman, members of the Subcommittee on the Environment and the Atmosphere. I appear before this body by virtue of my position as Chairman of the Gulf Coast Air Pollution Research Committee. This statement has been developed with the advice and concurrence of the whole committee and should therefore be taken to constitute the position of the entire committee and not simply as a personal expression.

The Gulf Coast Air Pollution Research Committee was organized on 19 October 1977. It was established in consequence of provisions of the 1977 Amendments to the Clean Air Act, requiring that the Environmental Protection Agency conduct research on a number of regional air pollution problems. This mandate arose from the fact that there is considerable uncertainty in the scientific community as to the origin and nature of the air pollution problems in a number of areas. This uncertainty generates questions as to the appropriateness and efficacy of control measures established or promulgated by EPA to accomplish the reduction of air pollution. The 1977 Amendments also mandated the establishment of local committees to assist the EPA in this admittedly complex and difficult research effort by assuring input from local experts who are especially knowledgeable concerning the local problems. The Gulf Coast Air Pollution Research Committee is one such entity, and the membership encompasses all of the local interests. Please accept my assurance, if any were needed, that my committee is exceedingly eager to provide such assistance to EPA.

Although the committee was established in October, substantive work did not begin until the very last portion of the year. On 16 December, a meeting was held in Houston attended by key people in the EPA research organization who would be concerned with what I shall refer to as the Houston or Gulf Coast Study. The atmosphere at the meeting was one of open and frank cooperation, which is not to say that there was complete agreement on all points. The members of my committee came away from this meeting in anticipation of a good and close working relationship with EPA's research scientists. Nonetheless we detected a distinct reluctance on the part of EPA to address the problem of ozone/oxidants in the Houston atmosphere. While I certainly do not wish to represent the oxidant problem as the only one we face, it certainly is at least as important as any other.

In a hearing by this Subcommittee held in Houston on 21 November, there was considerable technical discussion of the complexities of this subject which I will not repeat here. There have been significant developments since, especially the denial of the petition of the Texas Air Control Board for a waiver from the EPA offsets policy. As a result of this, Texas will be required to implement costly and potentially disruptive controls on industrial and other development in areas of our State - including the Gulf Coast - which are out of compliance with the particulate and oxidant standards.

The key point is that major actions are being taken to attempt attainment of a standard - and many feel that attainment is impossible on virtually any basis - which has an extremely tenuous technical foundation. This makes it even more important that research on the ozone/oxidant problem be implemented with dispatch in order that appropriate action can be taken to terminate disruptive programs if the results show the standard to be unnecessarily restrictive.

In early meetings of my committee, we enthusiastically supported a suggestion of the EPA research group that the first project implemented be a "needs assessment" - a review by a qualified research organization of the extensive data concerning Gulf Coast pollution and a reasoned judgment as to what research might be needed to elucidate all aspects of the problem - physical, chemical and the most critical, health effects. The committee requested an opportunity to review the draft Request for Proposal, as a result of which a copy was provided. The draft was found to be extremely directive in that it channelled the contractor heavily into the area of aerosols. The committee considers aerosols a problem requiring study, but there seemed to be no reason why the RFP should be as directive as it was. We suggested to EPA that a needs assessment might best be written as a needs assessment, i.e., leaving it to the judgment of the investigators to discern the needs, which after all is the purpose of the study in the first place. A revised draft was prepared and provided to the committee; it was still somewhat directive toward aerosols, but did allow for consideration of other pollutants. However, most surprisingly, the revised draft specifically excluded consideration of the health effects of ozone/oxidants. This must be considered a significant omission in view of the needs of the area and the extensive discussions between the committee and EPA research people. I have had further contact with a senior EPA research official, in which a willingness was indicated to remove this restriction, though it was suggested that the RFP may in fact have been issued to prospective contractors with the restriction.

As another aspect of the oxidant subject, I should like to remind this committee that a revised oxidant criteria document, which forms the basis for the definition of the ambient air quality standard, is now under review. Two members of my committee have been requested by EPA, independent of the committee and independent of each other, to review the draft document. One of these reviewers, Dr. H.C. McKee, serves in the Department of Public Health of the City of Houston, and the other, Dr. Richard K. Severs, is a member of the faculty of the School of Public Health of the University of Texas. Both have found the draft document seriously flawed, especially with respect to the research methodology employed in the association of ambient air levels of ozone/oxidants and health effects. I have appended to this testimony a presentation made before the EPA review committee by Dr. McKee on 30 January which includes the views of Dr. Severs. If the judgment of these highly qualified professionals is correct, we are imposing costly and disruptive regulatory requirements in prusuit of a standard that may be substantially in error. This affords further evidence of the imperative of doing the research to resolve this question.

EPA has stated that the stress placed by them on aerosols is a result of the language in the 1977 Amendments. This position would be justified, if only the language of the Act were available. However, there has been much discussion between my committee and EPA to convey a clear and unequivocal local view that research must be done on the ozone/oxidant question, though not to the exclusion of other matters. In addition, Senator Lloyd Bentsen, who was instrumental in incorporating the local research requirement in the legislation, has told me and senior EPA officials that it was his intention that the oxidant question be resolved. I have appended to this testimony a letter which I received from the Senator just last week which confirms my several contacts with him and his staff.

The situation which I have described illustrates a dilemma that goes quite beyond the specifics discussed. For some time, the Texas air pollution authorities have maintained that the Gulf Coast has a problem intrinsically different from that existing in Los Angeles, and therefore the Los Angeles-based controls will be ineffective. On the other hand, the Environmental Protection Agency, under Federal mandate but with limited resources has been called upon to develop and implement a national air pollution control program. This has resulted in the definition of two basic categories of air pollution problems: the "snow-belt" problem characterized by sulfur oxides and particulates, and the "sun-belt" syndrome of photochemical smog. What if there are situations which do not conform to either? Should it fall to the local area to prove that it has a different problem before Federally promulgated controls are imposed? Obviously this would be beyond the capabilities, financial and technical, of most local jurisdictions. It would equally obviously tax the Federal resources if it became necessary to study a very large number of special cases. This situation falls well within the truism that for every difficult problem there is a solution that is quick, easy, cheap - and wrong! What then might offer an approach to resolution?

First, it would seem reasonable that congress adopt a more realistic attitude toward deadlines. These are complex problems, and a legislative mandate that a question be resolved by a certain date does not guarantee success. Tight deadlines and the crisis mentality should be reserved for clear threats to the public health. Cooperative research is an obvious answer, but larger scale efforts almost certainly complicate the matter of meeting deadlines. An obvious need is for a more open and cooperative attitude among all concerned, and less of the compulsion to prove at all costs previously adopted positions. It has also long impressed me that there would be considerable merit to separating the research and regulatory functions, as was the carefully considered determination of the Congress in establishing two agencies, the National Institute for Occupational Safety and Health and the Occupational Safety and Health Administration to deal with health hazards in the workplace.

Given acceptance of the notion that these are complex technical matters, there is obviously a need for continuing oversight of the technical elements of any program, and certainly by an entity other than the agency concerned. Finally, logic dictates that if a regulatory action has been shown to be ineffective but otherwise onerous in a reasonable period of time, there should be mechanism for suspending the regulation pending the definition of a better solution without destroying an entire program.

The notion of cooperative research figures strongly in what I have presented here. This is devoutly to be wished, but very difficult to achieve. An essential of a successful cooperative research effort is for all parties concerned to want to work cooperatively. I regret to say that this ingredient is frequently lacking. Without becoming mawkish, I would hope that a more tolerant, respectful and trusting atmosphere could be established. We should dispense with attitudes such as that expressed by the statement in the EPA draft RFP for the Houston area needs assessment reading, "...viewpoints... are often conflicting and influenced by special interests." Having said all these heartwarming words, I must frankly tell you that I cannot offer a means for reducing the confrontational attitude that characterizes all too many aspects of the Federal-local relationships in the environmental area. As a final observation, I do recall that good, cooperative research did take place in the days before the crisis mentality and near-impossible deadlines were imposed by Federal fiat.

The Gulf Coast Air Pollution Research Committee maintains that it has a most important mission in providing informed, expert local viewpoints to EPA in the pursuit of this phase of their research. However, at this point, the committee is an informal aggregation of interested parties lacking any offical status or recognition. As was pointed out in the November hearing in Houston, the functioning of the committee would be improved by such sanction. We don't ask to be loved - only listened to! We have had official statements of endorsement and support from local and State agencies, but it is the Federal recognition that counts.

It has also become clear that the functioning of the committee in the manner intended by the legislation would be materially aided by some funds to support contact with EPA and research contractors. As of now, contacts with EPA can only be accomplished with funds which entail sacrifice to other activities or which may not be available at all. This is a serious impediment if we are to aid EPA in research planning and implementation, especially at this very early phase of a critical program. I would therefore suggest, speaking for the committee, that a small portion of the budget, or supplementary funds, be provided to support limited travel by committee members. We do not ask for any compensation, only reimbursement for transportation and reasonable living expenses. Such funding would also enable the committee to initiate actions rather than merely being responsive to requests from EPA. An important specific benefit of such support relating to the growing need for Federal, State and local cooperation is a greater likelihood that we will be able to integrate the EPA program to be developed with the extensive research program conducted under the Houston Area Oxidant Study, so that maximum use can be made of severely limited resources. We have an excellent opportunity to coordinate complement and supplement research if a close working relationship can be established.

To sum up, we have several components of the Gulf Coast Air pollution mix with insufficient data. The most critical question concerns the health effects of chronic exposure to our air. A budget of $3 million, however it may be spaced, must be considered a minimum commitment of time and money.

Mr. Chairman and members of the Subcommittee, I speak for a group that is exceedingly eager to discharge the function for which it was constituted. Our ability to do so will be strongly influenced by the extent to which we establish frank and open communication with the research staff and other officials of EPA. We are looking forward to expanded contacts at all levels, and we request that this Subcommittee do whatever it can to facilitate our task.

8 February 1978

COMMENTS ON PROPOSED REVISION OF OXIDANT STANDARD

(For presentation at public meeting to discuss issues related to a possible revision of the National Ambient Air Quality Standard for Photochemical Oxidants)

Prepared for
ENVIRONMENTAL PROTECTION AGENCY
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January 30, 1978

INTRODUCTION

The City of Houston Health Department appreciates the opportunity of commenting on the subject of proposed revisions of the Photochemical Oxidant Standard. As the local air pollution control agency for the City of Houston, our Air Pollution Control Program has worked for many years to alleviate some of the serious air pollution problems in the City. Substantial progress has been made, as shown by the fact that many of the most serious nuisances which existed in previous years have been eliminated, plus the fact that the ambient air quality standards for carbon monoxide, sulfur dioxide and nitrogen dioxide have not been exceeded at any of the City's monitoring stations for the past several years. The only violations of the primary particulate standard in 1977 occurred in portions of the industrial district and the downtown area, and a pilot program is under way to determine the reasons for these violations and to identify proper corrective actions for future implementation.

The most significant air pollution problem in the Houston area is that of photochemical oxidants, as shown by the occasional high ozone readings which are recorded. Based on the hydrocarbon control requirements of the Environmental Protection Agency as written into the State Implementation Plan, hundreds of millions of dollars have been spent in the Houston area during the past few years to reduce hydrocarbon emissions, on the assumption that such action would reduce ozone and photochemical oxidants. These expenditures include the cost of very substantial control measures by local industries and also the cost to the average motorist of catalytic converters, unleaded gasoline and other vehicle control measures. These efforts have undoubtedly improved air quality in several ways, but in terms of the original objective of reducing ozone episodes, they appear to have been a failure. Ozone episodes have not changed much in frequency or severity since before the controls were implemented; while some random year-to-year variation occurs due to changing weather patterns, it is obvious that any reduction in ozone formation has been much less than predicted at the time the control requirements were established. In fact, no statistically significant reduction in ozone episodes can be demonstrated!

Because of this major unsolved problem, the subject of proposed revisions to the oxidant standard is a matter of major importance to the Houston area. Additional control efforts are needed, but those control efforts must be effective if public disillusionment and loss of credibility for future control efforts are to be avoided. Therefore, it is imperative that a revised standard be developed which defines the nature and magnitude of the problem in the Houston area. Control measures required to achieve a revised standard must be based on an accurate understanding of the mechanism of ozone formation; these control measures must be more effective in reducing ozone episodes than the hydrocarbon reduction requirements which were implemented in the past few years.

The background documents furnished by EPA have been reviewed, including the following:

1.	A Method for Assessing the Health Risks Associated with Alternative Air Quality Standards for Photochemical Oxidants	Jan. 1978
2.	Summary Statement from the EPA Advisory Panel on Health Effects of Photochemical Oxidants	Jan. 1978
3.	Alternate Forms of the Ambient Air Quality Standard for Photochemical Oxidants	Jan. 1978
4.	Revision of the National Ambient Air Quality Standard for Photochemical Oxidants	Jan. 6, 1978

Comments are presented here on several portions of these documents, based on our experience in the Houston area and on factors which seem to be important in addressing the oxidant problem in Houston. While our experience is limited to the problems of the Houston area, the information presented here likely is applicable in other cities as well. However, it is important to stress that oxidant problems are not the same in every city. Some evaluation and understanding of the problem is necessary in each metropolitan area, if a standard is to reflect the actual problems in that area and especially if the control measures selected are to be effective in alleviating those problems.

RELATIONSHIP BETWEEN OXIDANT AND OZONE

In comments on External Review Draft No. 1 "Air Quality Criteria for Photochemical Oxidants and Oxidant Precursors" dated November 2, 1977, the City of Houston stated that the distinction between ozone and photochemical oxidants was not adequately explained. Despite the present attempts to change from an oxidant standard to an ozone standard, we find that some of the same confusion still exists. The distinction is not clear between the effects of ozone per se, and the effects of a mixture of oxidants, with ozone measurements being used as an indicator of the mixture. Epidemiological studies based on oxidant measurements in ambient atmospheres are used as support for a proposed ozone standard, despite the fact that ambient atmospheres inevitably will contain other contaminants in addition to pure ozone. The presumption that most of the adverse effects of oxidant are due to the ozone contained in such atmospheres does not seem to be supported very strongly by the available evidence.

This problem is aggravated in the Houston area by the problem mentioned in the previous comments on the criteria document, because of the lack of agreement between the potassium iodide measurements and the chemiluminescent measurements. Much of the air quality data used in evaluating health effects was obtained by potassium iodide methods; the lack of agreement between these methods in Houston raises serious questions about the validity of these data with respect to ozone and/or oxidant problems in Houston. This in turn tends to cast serious doubt on the presumption that any health effects in Houston would be due only to ozone. The applicability of the proposed ozone standard in the Houston area would also be open to question.

The change from an oxidant standard to an ozone standard appears to be justified. The use of ozone measurements as an indicator of an oxidant mixture is uncertain, because the relationship between ozone and other oxidant constituents appears to be highly variable and possibly unpredictable. However, the distinction between oxidant and ozone should be clear and unmistakable, both in the Criteria Document and in the development of a revised standard. Also, to protect public health, separate standards for PAN and possibly other oxidant constituents should be developed as soon as available information will permit.

NUMERICAL VALUE OF STANDARD

Our major objection to the proposed revision is the retention of the 0.08 ppm numerical value for an oxidant standard. We question the wisdom of extrapolating from "probable effects in the range of 0.15 to 0.25 ppm" to establish a standard of 0.08 ppm. The evidence presented in External Review Draft No. 1 of the Criteria Document does not seem to warrant this extrapolation as found in the background documents referenced above. As a public health agency, we would be delighted to achieve a standard which provided for essentially background conditions with little or no contamination from man-made sources. However, we believe that maintaining the Ambient Air Quality Standard at the current level of 0.08 ppm is unwise for two reasons.

First, the available information presents little or no credible evidence for any adverse effect below some value in the range of 0.15 to 0.25, as stated. Any evidence for any adverse effect below that range is unconfirmed, and not generally accepted within the scientific community. On the other hand, a number of scientific investigations have failed to find any adverse effects at lower levels. These studies with negative results below 0.25 ppm should also be mentioned in the summary. To discard numerous studies which find no adverse effects, and then to give total credence to one or two unconfirmed studies which indicate a slight possibility of such effects, is to violate all reasonable standards of scientific accuracy and credibility. Certainly, in legal terms, the preponderance of evidence would indicate that the threshold for significant adverse effects of ozone appears to be somewhere around 0.25 ppm for an exposure of around two hours.

The second reason for suggesting that a numerical standard of 0.08 ppm is undesirably low is the more practical matter of public acceptance and support. Ideally, any man-made changes in air quality should be kept to a minimum, and a standard considerably more restrictive than any level that can be justified by the available scientific data is acceptable and desirable, provided this lower level is capable of attainment. From a practical standpoint, however, attainment of a standard of 0.08 ppm would appear to be impossible during the foreseeable future, not only in Houston but in many other cities throughout the nation. Natural ozone levels, as EPA now recognizes, occasionally reach 0.05 to 0.06 ppm. Allowing for some possible errors in measurement, instrumental readings as high as 0.07 might be recorded occasionally, due entirely to natural atmospheric conditions that cannot be changed. Since the difference between the maximum probable reading due to natural conditions and the value of the standard is only 0.01 ppm, this allows practically no margin for any man-made influence. Almost total elimination of man-made oxidant precursors would be necessary to attain a standard of 0.08 ppm.

Such a degree of control appears to be impossible, especially when the oxidant precursors responsible for ozone formation in Houston have not even been identified. The lack of success with previous reductions in hydrocarbon emissions would indicate that further hydrocarbon reductions do not appear to be the answer. If oxides of nitrogen must be controlled to reduce ozone episodes in Houston, the technology for application to large stationary sources has not been developed, and thus cannot be available for many years. Unless some major breakthrough occurs that changes our understanding of the mechanism of ozone formation to a significant degree, there appears to be no possibility that a standard of 0.08 ppm can be attained within the foreseeable future.

We suspect that the same is true of many other cities in the nation. To retain the present numerical standard, and then to proceed with implementation plan revisions which by law must be "guaranteed" to attain this standard, will only deceive the public and lead to further disillusionment and loss of credibility. We suggest that a more realistic appraisal of the available information be conducted, and that a revised standard be promulgated that can alleviate the significant adverse effects of ozone without attempting to accomplish the impossible. In public health practice, there is no precedent for attempting to prevent all adverse effects in every individual member of the public. As commendable as this would be, our skills and technology do not permit us to achieve this degree of perfection.

As a first step in that appraisal, we suggest another consideration of the technique of "probability encoding" that was used in evaluating potential health risks. This procedure seems to be rather questionable in view of the nature of the data available. This method attempts to attach objective numerical measures to subjective judgments. Such a numerical expression cannot be any more accurate than the subjective judgment on which it is based, even though the act of manipulating a series of numbers creates the appearance of a higher degree of accuracy. This method is a variation of the Delphi technique, which is helpful in substituting subjective judgment for data when no data are available. However, it is not valid for extending the range or the applicability of experimental data; therefore, the use of this method to establish lower threshold limits based on experimental data in the range of 0.3 - 0.5 ppm is not valid.

USE OF AMBIENT AIR STANDARDS

We would like to express strong support for one statement made on Page 19 of Document No. 2 (Summary Statement...) listed above. This is the suggestion that an ambient air quality standard should be considered as a guideline which is used as a public health objective for developing control strategies, rather than as a signal for injunctive legal actions. This is the only way in which an ambient air quality standard can be used. Urban life is too complex to be drastically modified or rearranged without advance notice, if some air pollution monitoring instrument suddenly exceeds some magical number. This problem is especially important in using a standard for photochemical oxidants or ozone, since the exact mechanism of ozone formation is not known. The consequences of various control actions cannot be predicted accurately, and the public cannot be expected to make radical changes in lifestyle every time some complex atmospheric reaction turns out differently than expected. For example, a restriction on the use of private automobiles on high ozone days has been discussed; imagine the problems that would occur if people who drive to work in the morning are told at noon that they cannot drive their cars home that evening! (This was actually suggested a few years ago as a control measure to be considered.) Using the standard as a planning guide is a tremendous improvement over the administrative procedures of the past, where every single violation of a standard produced a demand for some immediate enforcement action or other immediate response by the state or local control agency.

STATISTICAL BASIS OF STANDARD

The problem of evaluating alternate forms of a standard and selecting a suitable statistical basis for expressing a standard is a formidable one, with no easy answers. We agree that a standard expressed as the second highest hourly reading in any one year is not satisfactory. At any single location in Houston, the two highest hourly readings in any one year frequently occur as consecutive hours on the same day. We agree also with the statement that annual average values are not appropriate. The use of an annual average is even less suitable for oxidant than for other contaminants because of the existence of natural background ozone during daylight hours. This natural ozone varies as a function of weather conditions, so an annual average is a very poor measure of ozone episodes of higher than normal concentration. However, it is these episodes that are responsible for any adverse effects which may occur, and which should be controlled. Any statistical form that is chosen must identify high ozone episodes if the standard is to achieve the objective of protecting public health.

As an additional item of interest, Table 2 of Document No. 3 (Alternate Forms....) lists the annual geometric mean as one of the alternate statistical forms to be considered. Since the logarithm of zero is minus infinity, any set of numbers which includes one or more values of zero cannot be averaged to determine a geometric mean and hence this alternative is theoretically impossible.

CONCLUSION

Much has been learned about photochemical oxidant since the original ambient air quality standard was promulgated in 1971. The staff of EPA is to be commended for the thorough, meticulous work that has been accomplished to assemble this information and to attempt to resolve problems due to inconsistent or missing pieces of the puzzle.

Unfortunately, our knowledge is still incomplete in some areas, especially our understanding of the variability in oxidant problems from one urban area to another. The oxidant problems of each area must be identified and understood, to see how they vary from the problems of other areas. This appears to be the biggest problem still remaining, before this type of air pollution can be controlled to a reasonable degree. We have made some progress in understanding the ozone episodes that occur in Houston, but we still lack answers on many important aspects of the problem.

Because of this variability, some flexibility is needed so that state and local control agencies can evaluate their individual problems and can develop control measures that will be effective in alleviating whatever health hazards exist. This flexibility is most important in developing control strategies, but should also be considered in developing a revised standard.

The hundreds of millions of dollars that have been spent in the Houston area without any measurable reduction in ozone episodes have already had a serious effect on the credibility of our air pollution control efforts and on the confidence of the public. Community leaders are naturally dismayed that this expenditure has not achieved the desired objectives. It is obvious that additional efforts are needed, but it is also obvious that these efforts must be effective. While there are no easy answers, we hope that the ideas presented here will be useful to the Environmental Protection Agency in developing realistic standards for photochemical oxidants and in establishing implementation plan requirements to attain such standards.

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United States Senate
COMMITTEE ON FINANCE
WASHINGTON, D.C. 20510

January 25, 1978

Dr. Stanley M. Pier, Chairman
Gulf Coast Air Pollution Research Committee
The University of Texas
Health Science Center at Houston
P.O. Box 20186
Houston, Texas 77025

Dear Dr. Pier:

Thank you for your recent letter.

I appreciate your taking the time to keep me up to date on the developments of the Gulf Coast Air Pollution Research Committee. I have discussed the study with both Mrs. Harrison and Dr. Shearer at EPA and I have made it clear that we expect the study to include a thorough analysis of both the sources and the control of oxidants in the Gulf Coast area. You can be assured that I intend to follow through on this commitment.

Again, thank you for contacting me.

Sincerely,

Lloyd Bentsen

Lloyd Bentsen

A Critique: A Method for Assessing the Health Risks Associated with Alternative Air Quality Standards for Photochemical Oxidants.

by R. K. Severs Ph.D.

This draft report prepared by staff of the Strategies and Air Standards Division, EPA, consists of a string of arguments that if accepted would justify an ambient air standard of 0.000000 parts per billion of anything. The mathematics or statistics of each step are internally consistent. The problem lies in the proper use of the techniques and the definition of each problem component. These total misconceptions and misplaced applications have to be accepted before the document can be taken seriously. Several examples are cited below.

First, decisional management techniques are frequently utilized to reduce variation and thus risks of bad decisions in areas in which no data exist. In these cases, data do not exist because no one has tried to collect data in that range, or previous data indicate the problem is in a different range. As applied to the oxidant/ozone exposure risks this implies that existing clinical or epidemiological evidence of risks now defines the concentration range of hazardous exposures. This is certainly not the case. If no scientific evidence of risk is discovered below this range or level a "no threshold" cannot be assumed and no extrapolation into a lower range can be justified. Clinical and epidemiological data exist with respect to ozone/oxidant exposure. Therefore the use of the method known as probability encoding cannot be justified and any standard must be based on clinical and epidemiological data that do exist.

Second, probability encoding represents the first step in a more sophisticated decisional management technique known as the "Delphi Method" developed by Rand Corporation. The purpose is again to reduce variation among experts where little scientific data exist in order to reduce the risks of bad decisions. The methodology requires a reiteration of the questions in an anonymous fashion with all experts having access to the previous opinion poll. After due reflection a second poll is conducted and then in a similar manner, the third. This repeated review is an essential characteristic of the technique. The product of this procedure is a strengt ening of the central tendency of the probability distribution with a reducti in outlying variation. Occasionally a bimodal distribution will occur if r disagreement exists among experts. But the point of the procedure is to fin the central tendency toward consensus. To use any method of this type to define risks by purposely creating a probability distribution of great varianc not following through with known techniques to reduce the variance, and then calculating a probability of risk for the extremes, is hazardous and imprope practice.

Third, there is some room for argument that the ozone health effects chosen for risk assessment are entirely appropriate. It has generally been considered in the past that momentary discomforts are part of a stressful existence and that the occurrence of reversible physiological effects due to the stress of pollutant exposures need not be considered as the criteria for the bases of an air quality standard. Thus, of the four categories chosen only reduced resistence to bacterial infection is well enough defined to be categorized as an adverse health effect and it has only been demonstrated in animals. Extent of damage and time of discomfort for categories are not defined. Introduction of a new concept of a health effect threshold instead of reliance on physiological response thresholds does not make clear or precise the meaning of a health effect.

The individual susceptibilities still underly the population distributions of susceptibility and are thus still related to individual physiological response levels. The population health effect threshold is difficult to define when approached from a group viewpoint. This original recognition several decades ago led to the reliance on clinical and epidemiological data as the best criteria for development of air quality standards.

Thus even though the individual components of the argument are well executed in developing a method for assessing the health risks associated with alternative air quality standards for photochemical oxidants, the components of the argument seem inappropriate, subject to disagreement, and in general misused.

Richard K. Severs, Ph.D., Associate Professor of Environmental Sciences, University of Texas Health Science Center at Houston, School of Public Health, P.O. Box 20186, Houston, Texas 77025

Mr. Brown. We have Dr. Gage scheduled as the last witness for any comments he might wish to make and I would like to invite Mr. David Shearer up also. He can fill in until Dr. Gage gets here.

STATEMENT OF DR. STEPHEN GAGE, ACTING ASSISTANT ADMINISTRATOR, OFFICE OF RESEARCH AND DEVELOPMENT, ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY DR. DAVID SHEARER

Dr. Shearer. Thank you, Mr. Chairman.

Mr. Brown. Do you have any comments, Mr. Shearer, with regard to the Houston study?

Dr. Shearer. Yes, Mr. Chairman, I would like to make a few comments in response to the testimony of Mr. Feldcamp. Also, I have read Dr. Pier's statement and would like to respond to several items within that statement.

EPA has begun on a large scale to involve the local Gulf Coast Air Pollution Research Committee in our design of the EPA study. We had a meeting with them in December. We are scheduled to have another meeting with them on February 22, in Houston, to continue our technical dialog and design our study.

Coupled with that February 22 meeting, the regional administrator in our region VI, Mrs. Harrison, will be present to give the official recognition, if you will, of the involvement of this local committee with EPA.

Mr. Brown. Is there some formal way in which this can be done?

Dr. Shearer. She is in the process, as I understand Mr. Chairman, of transmitting a letter from her to the committee next week indicating our recognition of this committee as a partner with us in the design elements of the conduct of the study.

In addition, at the February 22 meeting, we will have present health experts to have more detailed discussions on that aspect of the study with the local health officials, both the medical and the private health officials in the community, as well as the atmospheric chemistry experts.

We have received quite a bit of health data that have been gathered by the local people. We have the progress reports and the first annual report on the Houston air oxidant study for evaluation. We are planning to evaluate the health data and use all of this data that has been gathered by local people to date as input into the design for the EPA studies. We intend, Mr. Chairman, to continue this dialog with the local people and we are in telephone communication with them. We are also in communication with officials of the Texas Air Control Board. They are represented on the Gulf Coast Research Committee.

Those are some comments, Mr. Chairman, I would like to respond to in relation to Mr. Feldcamp's testimony.

I would also like to make an additional comment about EPA going into this particular study. We are going into it with no preconceived notions or ideas of what we are going to find or not going to find. We are going into it with a completely objective scientific open approach to find what we will. We are going to investigate not only the local atmospheric mix, but we are also going to investigate the transport in the area from other areas as well as natural sources ozones and/or their precursors. We also will be looking very carefully at some of the data that will be coming out of the study. I transmitted to Dr. Pier last week a detailed study outline, which Dr. Byerly has a copy of as well as Mr. Feldcamp, which explains in more detail what we plan to do this present fiscal year. We anticipate, barring unforeseen instrumentation procurement difficulty, beginning the monitoring in that area in June of this year.

In our early discussions with the full committee we have had discussions along the lines of areas in the monitoring and research work that the local universities, school of public health, and local people can participate in with us to help perhaps do some of the work. So we are carrying on this dialog, Mr. Chairman, with the local people.

Mr. Brown. I have stressed and this is a personal view but I think it is shared by other members of the committee and other Members of Congress from Texas—the view that we need to look upon this as an opportunity situation not a confrontation situation.

Dr. Shearer. Yes.

Mr. Brown. It has some of the elements which exist nationally and a resistance of large industry to making expensive changes without being absolutely sure that there is a sound basis for it. I see this as a chance for a cooperative analysis of the problem in the collection of the data and its analysis and the health effects study where they have their own very highly qualified health people in the community there to come up with what you might call a consensus—that might be a little too vocal to expect to get that—but at least to see what progress we can make in view of the fact that we may have to put a lot of pressure on the Gulf Coast industries.

I do not want to—and I know the Members of Congress and I suspect the administration do not want to—get into a big fight with all the people in Texas without having a very strong base on which to justify that. And this project I think provides an ideal opportunity to develop such a base.

Now, more specifically on the finances, how far is this million dollars in the budget for the current year going to go with regard to completing the work on scale that would do the job?

Dr. Shearer. Mr. Chairman, as you know, the funding for this fiscal year is at the million-dollar level. And we anticipate, pending congressional and OMB sanction, additional funding for the subsequent fiscal years 1979 and 1980.

Mr. Brown. At the same level?

Mr. Shearer. At approximately the same level, yes.

Mr. Brown. All right.

Dr. Gage. We may find that this is not adequate, Mr. Brown. What we are doing the first year is trying to get our hands around the problem.

Mr. Brown. When you have the scope of the problem then you can decide how much it is going to cost.

Now, Dr. Gage, we have had 3 interesting days of testimony which you started and are finishing, and you probably have been in on at least the thrust of the testimony intervening, I would like to have you offer any comments that you might wish to about any of the general themes that have emerged from the testimony.

If you forget what the themes are, I can remind you if you like.

Dr. GAGE. I really do not have any prepared closing statement, Mr. Chairman. I would reiterate that we are in a very exciting time in the research program at the Environmental Protection Agency. I think now with a firmer legislative basis for our regulatory program, our research is going to have a much more solid basis on which to fund its activities.

One thing that has impressed me in my 3 years in the Environmental Protection Agency is that it is incredibly difficult to plan and to execute research projects in the constantly changing flux of regulatory thrust, let alone regulatory deadlines. I think that is changing. I think the Congress and the administration, including the Environmental Protection Agency, are coming to one mind as to what we need to do, taking somewhat more realistic views of what our real thrusts are in terms of environmetnal protection, and we are focusing more of our attention and more of our resources on solving these problems.

I think that research may just be coming into its own in the Environmental Protection Agency. This may be wishful thinking, but from what I have seen, the contributions we have made in the past year, such as developing a criteria document for lead under the Clean Air Act, and providing the scientific and technological base for the trihalomethane standard for the interim drinking water standards, have been significant research inputs to the Agency's regulatory thrust.

I have emphasized this in talks and speeches a number of times, but I think if there is one new and really important factor that I have had the opportunity to deal with during my tenure, it is that of putting EPA on a more solid long-term research base. The National Academy study, the Authorization Act, and implementation of the recommendations of that NAS study—to put EPA in the business of conducting longer term exploratory anticipatory research—is just a very important step forward.

It really struck me full in the face as I was preparing speeches and testimony earlier this year that surprisingly no one or no group had really established the basis for the Office of Research and Development to conduct those types of activities. Consequently, there was always tension within the Agency as to whether EPA should even be involved in those long-term activities. Now I think that is changed and we will change with it. We made that change in a very straightforward way. It is up to us to bring that into reality.

We only have a modest amount of money in that anticipatory research category now—some $14 million. We do have a number of other associated research programs which probably bring the total in the general exploratory research area up to around $30 or $40 million. That may not even be enough, but it is certainly in the right focus—a very major difference from the situation even a few years ago when there was not any financial commitment from the Agency to be doing those types of activities.

I think working with the universities and broader scientific community to give those programs direction and to involve the people in those programs is going to make a little difference in 3 to 5 years in the credibility and reputation of the research in the Environmental Protection Agency.

I was not going to make an initial statement but those thoughts just came to mind.

Mr. **Brown**. That is a fine statement, Dr. Gage.

I would like to say a word, not exactly in response, but as a comment.

I have a feeling that the quality of the program is constantly improving. I hope the programs will continue to improve their focus and control. It is important that they be presented to the committee in a rational and understandable way. That is always going to pose a problem in a complex program such as you have. I want to compliment you on both of these to the extent that you have the responsibility for them.

That is not the whole of the problem.

The need for the longer term research and for what we might call the basic research as compared with the regulatory-oriented research I think still exists. It was disturbing to hear the witnesses this afternoon—for example from the Rall committee—in discussing the health effects of coal to state that we cannot specify the chemical species that are involved. We do not know the things that transport the chemical species, and obviously we cannot know the health effects if we do not know what the species are or the things they are transported on. You can be doing another test study on the effects of coal combustion and end up finding out that you did not have the basic data, what it was that was causing the health effects and how it is being distributed.

Now, as a mechanism several of the witnesses have suggested that these kind of research problems could best be addresed to a relationship with the broader research community, possibly the university community, and I know you have undoubtedly given thought to this. Probably along the lines of—we do not have enough money to keep our own labs going, how can we do university research.

But I think that this committee and possibly the Congress would look favorably upon some addition to the funding of ORD if it were recognized that this were part of a program in which we would involve the best research capabilities in the university community in attacking and solving these basic problems which for one reason or another have not been adequately attacked under the present program. I am speaking here without pretending the detailed knowledge of exactly what you are doing in your labs but I would ask you to comment on that possibility.

Dr. **Gage**. We have been doing some very serious thinking along just the lines which you outlined, Mr. Brown.

We were also instructed by the Congress to look at—in addition to the study concerning management of the research program—the feasibility of using research institutes, including university communities, which, I believe, is roughly the way it was worded. We have taken that second charge very seriously and have a panel of EPA scientists and engineers working now for 3 or 3½ months looking at those issues.

One of the ideas that we very definitely are considering would be the establishment of a limited number of university research centers with given areas of responsibility or areas of research. We do not have resources to establish multipurpose, multidisciplinary research laboratories.

On the other hand, I have been very much impressed in knowing, since I came from the university community, of excellent areas of work going on around the country. Since working in the Federal Government I have become aware of many more of these spots of expertise.

I think we can build activities in limited areas and establish such centers. This may be one of the areas that you want to examine very carefully in the coming year. We are going to have a report to you on March 31, with some suggestions as to how you might proceed to best combine our efforts with those of the university researchers. This may be one area that you would like to select as a growth area. If the experiments in the first year prove to be successful, then we could move up cautiously in adding additional centers.

I spent Monday with Dr. Dave Rall down at the National Institute for Environmental Health Sciences in North Carolina. I have been asked by Dr. Rall to be a member of his national advisory council for the center and we were in the process of reviewing grants and contracts that NIEHS puts out in the university community.

I was struck by the similarity of his approach and what we have been slowly evolving independently, and that is the use of centers. He does have a number of these special centers essentially to fill in gaps in the research spectrum. Most of the projects of the NIEHS are funded as a result of research proposals which are submitted to the Institute by university researchers. As NIEHS's staff reviewed the pattern of proposals over the years there were gaps in the spectrum of activities that the university researchers proposed. So they targeted a limited number of centers to fill in some of these gaps. We may be well along the way doing such things right now. One of the gaps we have perceived very clearly is that in the ground water research area, and I think we are moving out quite strongly to do something in that area. We seem to be converging on that particular problem from many different directions. In a limited number of other areas we may well be able to fill in areas of research that just are not being filled by any institutional effort at this time.

Mr. Brown. You will not forget the tremendous resources available in Ada, Oklahoma, for ground water research?

Dr. Gage. I certainly will not. I have already made that commitment, Mr. Brown.

Mr. Brown. Mr. Watkins?

Mr. Watkins. I would like to continue the discussion, Dr. Gage, because you have submitted some figures.

We talk about doing research in-house or out of house. As a businessman I alway have to figure in overhead. Anyone who takes a research grant has to figure in, Mr. Chairman, a certain amount of overhead. When a lot of work is not done in our research centers—like the laboratory at Ada—then we are underwriting sometimes as high as a third of our project costs for overhead, just for facilities. We could probably get a greater use of our research dollar by trying to make sure we have very efficient use of our facilities—maybe in-house contracts. And I think that we can get a tremendous amount of needed research taken care of. I have discussed it with you and I have discussed it with many others. I think that is being looked into as something we may want to do and I know you are well aware of that, but

I would like to indicate as we talk about research centers and university personnel some of them may definitely come and work and do this in-house because we may be losing 25 percent of the money for overhead expenses at a lot of the institutions.

I would like to go to one other question unless you would like to make a comment on that, Dr. Gage.

Dr. GAGE. I quite understand what you are saying, Mr. Watkins. I was just jotting down a couple of numbers here. I recall roughly $75 million—one-quarter of our budget—is tied in with the salaries and wages of the field personnel, the laboratory grants, et cetera, just to provide the basic staffing and facilities for our laboratory efforts. I think that would be considered a very low overhead when compared to most external institutions involving scientific and technical operations.

So we, in fact, are starting from a very cost-effective base and we dilute that to a considerable extent by turning so strongly to external contracts. We ought to look at ways to recapture some of the benefits of the local overhead operations.

Mr. WATKINS. I would like to ask about something that was discussed in the testimony of Dr. Miller and Dr. Rice. They talk about potential impact of proposed regulations on the water utilities.

Reading a couple more sentences of this I would like to focus on something. There is one EPA regulation for control of THM and synthetic organic chemicals to go into effect in mid-1979, and water utilities will have to react.

I am quite sure we in Congress are going to have another reaction. I would like to try to be a step ahead here, Mr. Chairman. They are going to have to make an analysis of the finished water; second, if a problem exists to conduct a study of available opportunities to solving the problem that indeed exists, and, third, adopting an approach for correcting the problem. I think this is an opportunity that maybe we should take to be out front because I think this is where a tremendous amount of criticism of EPA comes in—about some of the regulations that are put into effect.

They do not have a particular procedure. They do not know which way to go, which direction to take except to say you have got to do something about it. So I would like for us to think about this. I would like a word with you, Dr. Gage, on this particular facet because a couple of previous speakers have commented that most of these communities of 10,000 to 75,000 are using ground water or well water as their water base and that essentially of the other 37,000 or less population cities which encompasses basically all of my area use ground water. They are going to react to these regulations and rightly so. I think that we need to provide in our legislation and in the bill a method of making these analyses of how many communities do we have today, what percentage have problems like this, and what is the economic impact. And I plan to continue to make comments such as this because we have got to come with something to prevent all this reaction and hopefully to take care of the well water problem.

The next part is the assistance needed for water utilities. First, there has got to be some training to educate the parties to be affected. Second, technical assistance has got to be available. Third, a planned program of assistance to water utilities is probably going to be required.

Mr. Chairman. I think we may want to pursue this if you and the rest of the committee feel like it. We need to go for some guaranteed loans and probably grants to meet these requirements from EPA because many do not have a tax base to do that job. We must support the realistic regional approach for providing monitoring and laboratory services.

I am willing to spend some time with you and your staff, Dr. Gage, and Mr. Chairman, in discussing this and trying to develop a proposal to handle this before those regulations are in effect in 1979, because I think we are going to create one of the largest—I say we—I think the EPA regulations will create one of the largest impacts across this country.

They stated on page 16 that the total package would cost more than $100.000. Most of the communities just ain't got that kind of money.

Do you have any response to maybe moving in that direction?

Dr. GAGE. I would just say, pursuant to the Safe Drinking Water Act of 1974, Mr. Watkins, EPA is, of course, the Agency which is responsible for implementing the act passed by the Congress, but I do appreciate your recognition that the Congress does have a very big hand in this. That act does not really contemplate a major grant program for States and municipalities to meet those——

Mr. BROWN. Did it contemplate any kind of a grant or minor grant? This is not something comparable to the $25 billion that we are putting into waste disposal.

Dr. GAGE. No, I cannot say for sure that there were not minor grant activities in there, but there was not a major grant program.

Of course, you did put an authorization section into the Environmental R.D. & D Act for drinking water grants. There was not any corresponding appropriation so there is no funding to do that.

I guess I would probably even amplify your remarks, Mr. Watkins, and your point directly. I think that the regulations that we have established now or are proposing as the interim drinking water standards for cities over 75,000 probably can be met in most cases by the cities. They do have a good tax base. They are able to raise money. They have what technical expertise is available at the local level, and even with the estimated pricetag of something like $300 million for the activated charcoal systems for those 50-some cities that might have to put those units on, that is probably doable. If not, then I am sure you will be hearing from municipalities to give them some assistance.

Mr. WATKINS. I think Oklahoma City may be one of those and I think I have already seen the editorials about it.

Dr. GAGE. The thrust as I recall is primarily on surface waters. We do have the humic acid building up from decaying leaves interacting with the chlorine in the water treatment plant. That is the major health impact there. It is not all of the problem.

But there are two very major exceptions here. There is a ground water section—we have spent quite a bit of time talking about that in the last few days. There do appear to be contaminated groundwater supplies. The interim standards do not address that in a straightforward way. I am sure that the standard for trihalomethanes migh apply in some very indirect ways. But that is a standard basically for chlorine, and the contaminants that seem to be showing up in ground water supplies are many of the other types of organic chemicals, not chloroform.

The other major exception that I point out are the cities under 75,000 relying on surface waters for their drinking water supplies. The 75,000 limitation was drawn in order to keep the smaller cities from going under in terms of the economic burden. Now the smaller cities are concerned about their water supply. There have been measurements made of the water quality in a number of these places and there is contamination. I am sure you are going to be hearing about that.

We also are going to be hearing about that, and we are thinking about how we will take the next step in the Safe Drinking Water Act to extend the public health protection to a large number of additional people who are not covered under the interim standards proposed recently.

I guess to sum up we have two problems which have not yet been addressed.

Mr. Watkins. I will be looking forward to following up with you on some of this because I think we can do some preventive work here that will make all of our jobs a litttle more acceptable by the mass of people out there who we are supposed to be serving.

Dr. Gage. You mentioned training; I would like to speak up for a couple of my colleagues. Tom Jorling and David Hawkins, the assistant administrators for water and air programs, respectively. They both were faced, as a result of the zero-base budget review, with reductions in their training programs. In Jorling's case that meant a reduction in his drinking water supply training program. That is the program which has been training the State officials and State technicians in order that they may go on to train municipal expertise to meet these drinking water standards. That is just one of the other areas that did receive lower priority. So that is another place where the tight controls of priorities have possibly exacerbated some difficulties at the local level.

Mr. Brown. Just one additional question, Dr. Gage, a matter which came up during the course of the hearing.

Your statutory authority for multiyear funding of the research programs. Are there any impediments to multiyear funding that you know of?

Dr. Gage. There is one that comes to mind immediately and that is that the funds that we are appropriated have a 2-year limitation on them. In other words, if we do not expend them within 2 years, they lapse, and we have to come back for a new appropriation. We can get around that to an extent by what we call front-end funding of a research proposal. That starts a certain momentum in the research program in that we have to have fairly large blocks of money available to front-end fund research center which, say, might be running at one-half million dollars a year and we want to fund that for 3 to 5 years. That means we have to have $1.5 or $2.5 million in hand when we set that center into motion. Now that just distorts everything else we are trying to do during the startup year, and probably also distorts things during the next couple of years because we had to arrange the program to come up with the front-end funding. I think that is something that will bear our mutual investigation.

Mr. BROWN. Maybe after we have gone through enough of these hearings we will want to go back to 2- or 3-year authorization hearings legislation.

Dr. GAGE. Does that mean more or less hearings for me?

Mr. BROWN. That means less hearings. [Laughter.]

I did want to commend you for designating Mr. Shearer to be the focal point for the Houston study. We certainly look forward to continued reports on how that is going along.

Recognizing the lateness of the hour and other factors, I think we will refrain from further questioning and again thank you for your assistance and cooperation and the excellent quality of your presentation even though we did not necessarily agree with it in every detail

With that the subcommittee will be adjourned.

[Whereupon, the subcommittee was adjourned at 5:45 p.m.]

COMMENTS ON TEXAS HYDROCARBON/PHOTOCHEMICAL OXIDANT STRATEGY

MEDICAL CENTER, HOLIDAY INN
DECEMBER 14, 1976, 10:00 A.M.

PRESENTED TO THE FEDERAL ENVIRONMENTAL
PROTECTION AGENCY

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REPORT PREPARED BY: CITY OF HOUSTON HEALTH DEPARTMENT

THE POLLUTION CONTROL PROGRAM OF THE CITY OF HOUSTON HEALTH DEPARTMENT, AS THE LOCAL ENFORCEMENT AGENCY FOR THE CITY OF HOUSTON, PRESENTS THIS TESTIMONY CONCERNING THE PORTIONS OF THE PROPOSED AMENDMENTS TO THE HYDROCARBON/PHOTOCHEMICAL OXIDANT STRATEGY FOR TEXAS THAT AFFECT THE CITY OF HOUSTON AND ITS RESIDENTS. THE CITY OF HOUSTON HAS HAD AN EFFECTIVE POLLUTION CONTROL PROGRAM FOR MANY YEARS AND, IN COOPERATION WITH OTHER AGENCIES AT THE FEDERAL, STATE, AND LOCAL LEVEL, HAS ACCOMPLISHED MUCH TO ALLIEVIATE ENVIRONMENTAL PROBLEMS IN THE CITY AND PREVENT NEW PROBLEMS FROM DEVELOPING AS THE CITY AND THE SURROUNDING AREAS CONTINUE TO GROW AND EXPAND. HOWEVER, CONTINUED STUDY IS NECESSARY TO IDENTIFY REMAINING PROBLEMS OR NEW PROBLEMS THAT MAY OCCUR, AND CONTINUED EFFORT IS REQUIRED TO MAINTAIN A SATISFACTORY DEGREE OF CONTROL OVER THESE PROBLEMS.

OF ALL THE ENVIRONMENTAL PROBLEMS IN THE HOUSTON AREA, NONE HAS BEEN MORE PERPLEXING OR MORE DIFFICULT TO SOLVE THAN THE PROBLEM OF SO-CALLED PHOTOCHEMICAL SMOG. SINCE THE OXIDANT STANDARD WAS PROMULGATED BY THE ENVIRONMENTAL PROTECTION AGENCY IN APRIL, 1971, CONTINUING STUDY AND EVALUATION BY THE CITY OF HOUSTON AND MY MANY OTHERS HAS PROVIDED SOME UNDERSTANDING OF THE NATURE OF THIS PROBLEM IN HOUSTON, BUT ADEQUATE KNOWLEDGE TO PERMIT THE ESTABLISHMENT OF POSITIVE CONTROL EFFORTS TO ACHIEVE THE EPA STANDARD IS STILL LACKING. AS OUTLINED IN PREVIOUS TESTIMONY BY THE CITY OF HOUSTON AT SEVERAL HEARINGS, THE

CITY HAS IMPLEMENTED A NUMBER OF CONTROLS AIMED AT REDUCING VEHICULAR CARBON MONOXIDE EMISSIONS, AS WELL AS HYDROCARBON EMISSIONS FROM BOTH VEHICULAR AND STATIONARY SOURCES. THESE INCLUDE THE LOCAL ENFORCEMENT PROGRAM BASED ON REGULATION V AND OTHER REGULATIONS OF THE TEXAS AIR CONTROL BOARD, AS WELL AS LOCAL ORDINANCES, AND ALSO SEVERAL TRANSPORTATION MEASURES, INCLUDING IMPROVEMENTS IN HOUTRAN, THE CITY-OWNED BUS SYSTEM; A MINIBUS SYSTEM SERVING THE CENTRAL BUSINESS DISTRICT; IMPROVEMENTS IN TRAFFIC CONTROL; CARSHARE, A COMPUTER-BASED CARPOOL MATCHING SYSTEM, AND PARK-AND-RIDE FACILITIES NEAR THE DOWNTOWN AREA. THESE WILL BE DESCRIBED IN SEPARATE TESTIMONY BY THE CITY'S OFFICE OF PUBLIC TRANSPORTATION.

THESE MEASURES HAVE BENEFITTED THE PEOPLE OF HOUSTON BY MINIMIZING TRAFFIC DELAYS AND REDUCING EMISSIONS FROM VEHICLES AS MUCH AS POSSIBLE WITH EXISTING STREETS AND FREEWAYS, AND WITHOUT EXCESSIVE COST OR DISRUPTION OF ESSENTIAL TRANSPORTATION TO THE PUBLIC. THE RESULTS IN TERMS OF AIR QUALITY HAVE BEEN MIXED.

FIRST, THESE EFFORTS, AND PERHAPS TO A GREATER EXTENT THE FEDERAL STANDARDS LIMITING EMISSIONS FROM NEW VEHICLES, HAVE REDUCED CARBON MONOXIDE LEVELS DRAMATICALLY. MONITORING STATIONS OF BOTH THE CITY OF HOUSTON AND THE TEXAS AIR CONTROL BOARD HAVE SHOWN LEVELS EXCEEDING THE EPA STANDARD AN AVERAGE OF ONLY 3 TIMES PER YEAR. THIS DOES NOT MEAN THAT WE CAN FORGET CARBON MONOXIDE; CHANGES OR INCREASES IN TRAFFIC DENSITY COMBINED WITH UNUSUALLY SLOW TRAFFIC ON A DAY OF METEOROLOGICAL STAGNATION STILL MIGHT CAUSE AN

INCREASE IN THE NUMBER OF VIOLATIONS. BUT FOR NOW, IT APPEARS THAT CARBON MONOXIDE DOES NOT POSE ANY SIGNIFICANT THREAT TO THE PEOPLE OF HOUSTON. WITH THE MORE RESTRICTIVE EMISSION STANDARDS APPLICABLE TO NEW VEHICLES, THERE IS EVERY REASON TO HOPE AND BELIEVE THAT THIS WILL CONTINUE TO BE TRUE.

UNFORTUNATELY, THE OXIDANT STANDARD PRESENTS A DIFFERENT STORY. OZONE LEVELS, WHICH ARE THE MEASUREMENTS SPECIFIED TO DETERMINE COMPLIANCE WITH THE OXIDANT STANDARD, CONTINUE TO EXCEED THE STANDARD FREQUENTLY. ACCORDING TO TEXAS AIR CONTROL BOARD INVENTORY FIGURES, THE COMBINATION OF CONTROL MEASURES DESCRIBED ABOVE HAS RESULTED IN A REDUCTION OF APPROXIMATELY 40% IN HYDROCARBON EMISSIONS FROM ALL SOURCES, COMPARED TO THREE OR FOUR YEARS AGO WHEN CONTROL EFFORTS WERE JUST BEGINNING. ACCORDING TO THE "LINEAR ROLLBACK" OR "PROPORTIONAL ROLLBACK" PRINCIPLE THAT IS THE BASIS FOR THE CONTROL MEASURES BEING DISCUSSED TODAY AND OTHERS THAT WILL BE PROPOSED IN THE FUTURE, THIS SHOULD HAVE RESULTED IN A REDUCTION IN OZONE LEVELS OF AROUND 40%. NO SUCH REDUCTION HAS OCCURRED. IN FACT, 1976 SO FAR HAS SHOWN MORE "HIGH OZONE" DAYS THAN ANY OTHER YEAR SINCE ADEQUATE MONITORING RESULTS WERE OBTAINED. (EXHIBIT A). THIS MAY BE DUE IN PART TO AN UNUSUALLY LARGE NUMBER OF DAYS DURING 1976 WHEN METEOROLOGICAL STAGNATION OCCURRED. BUT THIS LACK OF ANY CORRELATION SUGGESTS THAT THE MEASURES TAKEN SO FAR HAVE NOT BEEN EFFECTIVE IN IMPROVING AIR QUALITY, AT LEAST IN MOVING TOWARD ACHIEVEMENT OF THE PHOTOCHEMICAL OXIDANT STANDARD. CERTAINLY, IF

HYDROCARBON REDUCTIONS OF THE MAGNITUDE AS STATED EARLIER HAVE BEEN ACCOMPLISHED WITHOUT ACHIEVING THE DESIRED REDUCTION IN OZONE LEVELS, IT WOULD SEEM APPROPRIATE TO RE-EVALUATE THE SITUATION.

THE SCIENTIFIC QUESTIONS THAT HAVE BEEN RAISED CONCERNING THE APPLICATION OF THIS STANDARD IN HOUSTON HAVE BEEN MANY AND VARIED, AND HAVE BEEN RAISED BY A NUMBER OF SCIENTISTS. THESE QUESTIONS WILL NOT BE REVIEWED HERE, BUT IT IS APPROPRIATE TO MENTION TWO NEW ITEMS OF INFORMATION THAT ADD TWO MORE PIECES TO THE JIGSAW PUZZLE THAT EVERYONE IS TRYING TO ASSEMBLE TO UNDERSTAND THIS COMPLEX PROBLEM.

THE FIRST NEW EVIDENCE CONCERNS THE NON-METHANE HYDROCARBON STANDARD THAT ACCOMPANIES THE OXIDANT STANDARD AND FORMS THE BASIS FOR THE PRESUMED RELATIONSHIP BETWEEN HYDROCARBON EMISSIONS AND OXIDANT FORMATION. SEVERAL BRIEF STUDIES IN THE PAST HAVE PROVIDED RESULTS THAT RAISED QUESTIONS ABOUT POSSIBLE NATURAL CONSTITUENTS OF THE ATMOSPHERE THAT WERE MEASURED AS NON-METHANE HYDROCARBONS, BUT NOW A MORE COMPREHENSIVE STUDY HAS BEEN COMPLETED. EXPERIMENTAL DETAILS WILL BE PRESENTED IN OTHER TESTIMONY AT THIS HEARING BY DR. RICHARD SEVERS OF THE UNIVERSITY OF TEXAS SCHOOL OF PUBLIC HEALTH. THIS STUDY SUGGESTS THAT NON-METHANE HYDROCARBON LEVELS IN RURAL AREAS AROUND HOUSTON EXCEED THE EPA STANDARDS AND, THEREFORE, MAY BE UNATTAINABLE.

A MAJOR UNANSWERED QUESTION CONCERNS THE REACTIVITY OF THESE PRESUMABLY NATURAL MATERIALS IN THE ATMOSPHERE.

IF THEY PARTICIPATE IN PHOTOCHEMICAL REACTIONS TO FORM OZONE, AS GASOLINE VAPOR AND OTHER MAN-MADE HYDROCARBONS DO, THEN NO DEGREE OF REDUCTION IN MAN-MADE HYDROCARBON EMISSIONS CAN ELIMINATE OZONE FORMATION. IF THIS IS TRUE, THEN THE ENTIRE SYSTEM IN THE HOUSTON AREA MAY BE DEPENDENT ON OXIDES OF NITROGEN RATHER THAN HYDROCARBONS, SINCE THE REACTIVE OXIDES OF NITROGEN PRESUMABLY RESULT PRIMARILY FROM MAN'S ACTIVITIES AND NOT TO ANY SIGNIFICANT DEGREE FROM NATURAL ORIGINS. LABORATORY EXPERIMENTS SUGGEST THAT THE ENTIRE REACTION MECHANISM IS SENSITIVE TO CHANGES IN THE RATIO BETWEEN HYDROCARBONS AND OXIDES OF NITROGEN, AND THAT REDUCING HYDROCARBONS MAY INCREASE PHOTOCHEMICAL SMOG INSTEAD OF DECREASE IT, IF OXIDES OF NITROGEN ARE NOT REDUCED PROPORTIONATELY. IT WOULD BE EXTREMELY IRONIC IF THE MASSIVE CONTROL EFFORTS SO FAR HAVE MADE THIS PARTICULAR TYPE OF PROBLEM WORSE INSTEAD OF BETTER.

THE SECOND ITEM OF NEW EVIDENCE IS ONLY CIRCUMSTANTIAL IN NATURE, BUT FROM A HEALTH POINT OF VIEW, IS DISTURBING. DURING THE PAST 20 YEARS OR SO THAT INTERMITTENT SCIENTIFIC STUDES HAVE BEEN MADE OF HOUSTON'S AIR POLLUTION PROBLEMS, THERE HAVE BEEN ONLY RARE DOCUMENTED INCIDENTS THAT SUGGEST THE LOS ANGELES-TYPE EYE IRRITATION. THESE REPORTED INSTANCES OF EYE IRRITATION HAVE BEEN CLOSE TO NEARBY CHEMICAL PLANTS, SUGGESTING THAT ACCIDENTAL RELEASES OF IRRITATING CHEMICALS WERE THE CAUSE. DURING THE PAST YEAR, HOWEVER, AN INCREASED NUMBER OF UNSOLICITED COMPLAINTS OF

EYE IRRITATION WERE RECEIVED BY THE CITY OF HOUSTON HEALTH DEPARTMENT THAT COULD NOT BE ATTRIBUTED TO A NEARBY CHEMICAL PLANT OR OTHER OBVIOUS SUSPECT. THIS RAISES THE SERIOUS QUESTION OF THE SOURCE OF THESE IRRITATING MATERIALS. ARE THEY FORMED BY PHOTOCHEMICAL REACTIONS IN THE ATMOSPHERE? ARE THEY SIMILAR TO THE MATERIALS THAT CAUSE EYE IRRITATION IN SOUTHERN CALIFORNIA? DOES THIS INDICATE A CHANGE IN THE NATURE AND EXTENT OF PHOTOCHEMICAL SMOG IN HOUSON THAT IS NOT MEASURED BY THE OZONE INSTRUMENTS? OZONE AT THE LEVELS OCCURRING IS NOT KNOWN TO CAUSE EYE IRRITATION, BUT OZONE IS USED AS AN INDICATOR OF THE ENTIRE PHOTOCHEMICAL SMOG COMPLEX. IF THIS COMPLEX MIXTURE IS BEGINNING TO CONTAIN MATERIALS THAT CAUSE EYE IRRITATION, ARE THESE CHANGES RELATED TO THE SUBSTANTIAL REDUCTION IN HYDROCARBON EMISSIONS THAT HAS TAKEN PLACE?

THESE QUESTIONS CANNOT BE ANSWERED NOW, BUT THE CITY OF HOUSTON HEALTH DEPARTMENT INTENDS TO DO EVERYTHING POSSIBLE TO OBTAIN ANSWERS. THIS IS ONE MORE AREA IN WHICH MORE INFORMATION IS ESSENTIAL, IF FUTURE CONTROL EFFORTS ARE TO BENEFIT THE PUBLIC. THE CITY PETITIONS EPA TO JOIN IN THIS SEARCH, AND TO LEARN MORE ABOUT THIS PARTICULAR PROBLEM BEFORE ADDITIONAL COSTLY AND DISRUPTIVE CONTROL MEASURES ARE PROMULGATED. THIS IS APPARENTLY THE INTENTION OF EPA IN DIVIDING THE OXIDANT CONTROL STRATEGY INTO AN INTERIM PLAN AND A LONG RANGE PLAN. THE CONTROLS PRESENTLY PROPOSED DO NOT APPEAR TO INVOLVE EXCESSIVE COST OR DISRUPTION FOR THE PUBLIC, BUT WE WOULD URGE THAT A MUCH BETTER

UNDERSTANDING OF THIS PROBLEM BE OBTAINED BEFORE ADDITIONAL MEASURES ARE PROPOSED.

TURNING NOW TO THE SPECIFID MEASURES PROPOSED IN THE FEDERAL REGISTER ON NOVEMBER 11, 1976, I WOULD LIKE TO COMMENT ON THOSE THAT ARE OF CONCERN TO THE CITY OF HOUSTON HEALTH DEPARTMENT.

SECTION 52.2294 REQUIRES THE STATE AND/OR LOCAL AGENCIES TO COMPLETE A FEASBILITY STUDY OF MEASURES TO INCREASE THE USE OF BUSES OR OTHER MASS TRANSIT FACILITIES AND CARPOOLS. THE CITY OF HOUSTON WILL ASSIST IN THIS STUDY IN ANY WAY POSSIBLE, SHARING INFORMATION ON PREVIOUS EXPERIENCES AND PROBLEMS WITH THE CarShare PROGRAM, WITH ATTEMPTS TO IMPROVE THE HouTran SYSTEM, WITH WORK IN TRAFFIC CONTROL, AND ANY OTHER PERTINENT EFFORTS. THE CITY HAS MADE MAJOR EFFORTS IN THESE AREAS, AND IT IS HOPED THAT THIS EXPERIENCE WILL BE USEFUL IN PLANNING FURTHER EFFORTS.

SECTION 52.2296 REQUIRES THAT FOUR CITIES IN TEXAS, INCLUDING HOUSTON, IMPLEMENT A CARPOOL MATCHING AND PROMOTION SYSTEM. AS PRESENTLY PROPOSED, THE CarShare PLAN BEING OPERATED BY THE CITY APPEARS TO MEET ALL OF THE REQUIREMENTS SPECIFIED. IF THIS REGULATION IS PROMULGATED AS PROPOSED, THE REPORTS SPECIFIED WILL BE PREPARED FOR SUBMISSION TO THE REGIONAL ADMINISTRATOR.

SECTION 52.2297 REQUIRES MASS TRANSIT AND CARPOOL INCENTIVE PROGRAMS BY EMPLOYERS AND EDUCATIONAL INSTITUTIONS LARGER THAN A SPECIFIED MINIMUM SIZE. PARAGRAPH (c) (5) OF THAT SECTION REQUIRES A CARPOOL MATCHING PROGRAM, EITHER

ALONE OR AS A PORTION OF A LARGER PROGRAM. FOR MANY EMPLOYERS AND EDUCATIONAL INSTITUTIONS IN THE HOUSTON AREA, THE CITY'S CARSHARE PROGRAM MAY MEET THIS REQUIREMENT AND IS AVAILABLE TO FILL ANY NEEDS THAT IT CAN MEET.

NEXT, WE WOULD LIKE TO COMMENT ON THE QUESTIONS RAISED CONCERNING INSPECTION/MAINTENANCE OF MOTOR VEHICLES. IN PRINCIPLE, AN INSPECTION SYSTEM LEADING TO BETTER VEHICLE MAINTENANCE WOULD PROVIDE SIGNIFICANT BENEFITS, BOTH FOR AIR QUALITY IN THE COMMUNITY, AND FOR THE MOTORIST. BETTER MAINTENANCE MAY ALSO HELP TO SAVE GASOLINE, ALTHOUGH EXCESSIVE EMISSIONS AND WASTED GASOLINE DO NOT NECESSARILY OCCUR SIMULTANEOUSLY.

HOWEVER, IT APPEARS THAT THERE ARE MANY PROBLEMS TO BE SOLVED BEFORE AN INSPECTION/MAINTENANCE PROGRAM WILL BE ABLE TO PROVIDE SIGNIFICANT BENEFITS AT REASONABLE COST. THE EXHAUST GAS ANALYZERS NOW AVAILABLE ARE EXPENSIVE, AND THEY REQUIRE SKILLED PERSONNEL FOR MAINTENANCE AND CALIBRATION. FOR ANY MANDATORY INSPECTION SYSTEM, AN EXTENSIVE SYSTEM OF CALIBRATION AND QUALITY CONTROL WOULD BE ESSENTIAL, COVERING ALL INSPECTION STATIONS, AS WELL AS ALL FACILITIES WHERE REPAIR AND TUNE-UP WORK COULD BE PERFORMED TO OBTAIN COMPLIANCE. OTHERWISE, A CAR THAT FAILED INSPECTION AT ONE STATION MIGHT PASS AT ANOTHER. OR, A MOTORIST WHOSE CAR FAILED MIGHT BE TOLD TO GET A TUNE-UP WHEN IN FACT HIS CAR WOULD PASS IF TESTED PROPERLY.

THE FEDERAL REGISTER LISTED SPECIFIC QUESTIONS OF INTEREST REGARDING INSPECTION/MAINTENANCE PROGRAMS. THE FIRST CONCERNS THE ROLE OF FEDERAL, STATE AND LOCAL GOVERNMENTS. IT IS DIFFICULT TO SEE HOW CITIES COULD EFFECTIVELY CONDUCT SUCH A PROGRAM. THE CITY OF HOUSTON HAS JURISDICTION ONLY WITHIN THE HOUSTON CITY LIMITS, NOT IN THE 31 OTHER INCORPORATED CITIES IN HARRIS COUNTY OR IN THE UNINCORPORATED AREAS OF THE COUNTY, EXCLUDING AREAS OF EXTRA-TERRITORIRAL JURISDICTION FOR CERTAIN PURPOSES. EVEN A COUNTY-WIDE PROGRAM COULD COVER ONLY A PORTION OF THE VEHICLES THAT MIGHT CONTRIBUTE EMISSIONS, SINCE MANY VEHICLES FROM SURROUNDING COUNTIES COME INTO HOUSTON DAILY OR WITH SOME FREQUENCY. THEREFORE, IT WOULD SEEM THAT LEGAL REQUIREMENTS AND IMPLEMENTATION SHOULD BE A STATE FUNCTION. THE PRESENT VEHICLE SAFETY INSPECTION IS ALSO A STATE REQUIREMENT, AND EMISSIONS CONTROL COULD MOST LOGICALLY BE COMBINED WITH THE SAFETY INSPECTIONS.

A TEST BASED ON A COMPLETE DRIVING CYCLE IS MORE LIKELY TO PROVIDE VALID RESULTS THAN AN IDLE-ONLY TEST, BUT THE COST AND COMPLEXITY ARE SUCH THAT THIS LIKELY WILL NOT BE FEASIBLE. THEREFORE, PRACTICAL CONSIDERATIONS LIMIT THE AVAILABLE METHODS TO THE IDLE-ONLY TEST, THUS FURTHER DECREASING THE POTENTIAL VALUE OF AN INSPECTION/ MAINTENANCE PROGRAM.

ANOTHER FACTOR TO BE CONSIDERED IS THE RELATIVE IMPORTANCE OF VEHICLE EMISSIONS IN CAUSING OR AFFECTING HOUSTON'S AIR POLLUTION PROBLEMS. THE PEOPLE OF HOUSTON HAVE DEMONSTRATED A CONCERN FOR AIR QUALITY AND A WILLINGNESS TO TAKE

THE NECESSARY STEPS AND PAY THE NECESSARY PRICE FOR IMPROVED AIR QUALITY. HOWEVER, AS DISCUSSED FREQUENTLY IN THE PAST FEW YEARS, THE AVAILABLE EVIDENCE INDICATES THAT VEHICLE EMISSIONS ARE A RELATIVELY MINOR CONTRIBUTOR TO WHATEVER PROBLEMS EXIST IN THE HOUSTON AREA. THIS WILL UNDOUBTEDLY AFFECT THE PUBLIC'S REACTION TO AN INSPECTION/MAINTENANCE PROGRAM.

FINALLY, WE WOULD LIKE TO REQUEST THAT ANOTHER HEARING BE HELD ON THE ADDITIONAL CONTROL MEASURES THAT WILL BE PROPOSED AS THE SECOND PORTION OF THE INTERIM PLAN IN THE SPRING OF 1977.

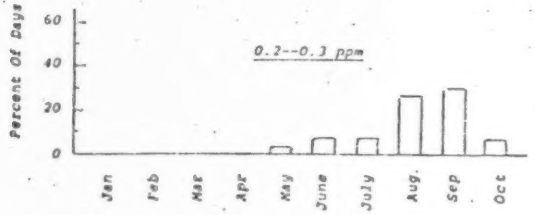
BOTH IN THE DEVELOPMENT OF THESE ADDITIONAL CONTROLS, AND IN EVALUATION AND PROMULGATION OF THE CONTROLS ALREADY PROPOSED, THE CITY WILL PROVIDE ANY ASSISTANCE POSSIBLE TO EPA, THE TEXAS AIR CONTROL BOARD, AND OTHER AGENCIES INVOLVED. THE CITY OF HOUSTON HAS MADE A FIRM COMMITMENT TO IMPROVING THE ENVIRONMENT AND TO SAFEGUARDING THE IMPROVEMENTS ALREADY ACHIEVED. WE WANT TO DO EVERYTHING POSSIBLE TO UTILIZE ALL CONTROLS THAT ARE FEASIBLE AND THAT WILL IMPROVE AIR QUALITY IN THE CITY OF HOUSTON AND THE SURROUNDING AREA AND WE WANT TO DO IT IN A RESPONSIBLE MANNER.

EXHIBIT A

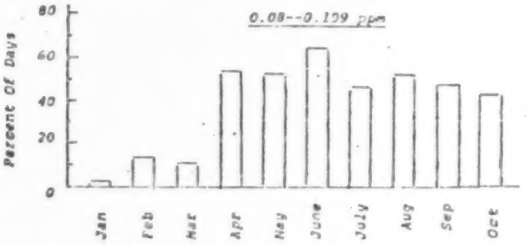
1976 CHAMPS DATA

PERCENT OF DAYS HAVING PEAK HOURLY OZONE

LEVELS IN THE INDICATED RANGES



Health Department Air Pollution Bulletins are issued when ozone reaches 0.2 ppm.



------------------ E. P. A. standard is 0.08 ppm.---------------------------